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A New Approach

We suppose that by a feat of mathematical gymnastics, a genius could work out some formula for assessing the relative productivity of diverse manufacturing concerns. Indeed, Mr. Kenneth Marshall has in an erudite Paper presented to a recent meeting of the British Institute of Management indicated some of the fundamentals. Yet he rightly lays stress on the profit to be gained by the group study of cost data and the like. Such studies could usefully be done either locally by firms worrying about common problems or nationally by concerns making a similar line of goods. The solution he cites has been made easier by a proposed development within the industry.

There are so many calls on the time of executives nowadays that only matters of the most urgent nature can be expected to cause them to absent themselves from their works and make long journeys. Happily, there is cognisance of this aspect also under consideration. It was announced at the annual general meeting of the British Cast Iron Research Association that attention is being given to the creation of a number of branch establishments in the various foundry centres. There is not a pressing need for still more chemical laboratories, as private enterprise has already met the needs. There is need, however, for *Bureaux de Prix*, such as have been established throughout France and which we dealt with in this column some eighteen months ago. We would not suggest that each distinct establishment should follow one pattern, as the requirements vary enormously. The main feature is to provide each foundry group with means for "self" examination, using the word "self" to mean the manufacturing organisation within one's sphere. Obviously this can only be done by comparison with other people's efforts and, to do it intelligently, the proposition has to be broken down into sections. It is quite customary, before installing new plant, meticulously to examine current conditions, to estimate the savings that will accrue through plant changes or additions and then when properly working to check up on the estimate. It is equally sane to be in full possession of the knowledge that one's melting costs, or scrap losses, are high or low compared with general practice. It immediately tells the management where time and money must be spent or perhaps just commonsense principles applied.

We see in the installation of district offices or laboratories, call them what you will, an ideal means of raising the general level of ironfounding practice throughout the country. They would form an informal meeeting place where day-to-day problems could be discussed and followed through with no loss of time. Such a service would eclipse in usefulness anything that has been operated in the past. The problem of staffing, however, would not easily be solved.

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Notes from the Branches

Middlesbrough

AN INTERESTING PAPER was given to the Middlesbrough branch of the Institute of British Foundrymen at a meeting held on October 13 by Mr. L. W. Bolton and Mr. W. D. Ford, of Wellingborough, on the subject of "Modernising an Iron Foundry". The meeting was well attended and after the lecture (the subject matter of which has already been published in the Journal*) a very interesting discussion took place.

Whilst the lecturers had made it clear that their factory was a small one not engaged on a great variety of castings as was the case in most Teeside foundries, there was no doubt that many ideas were quite applicable to the larger works. Particular interest was shown in the kinds of sand which were used and MR. STANLEY was of the opinion that if coarse sand was used the permeability was increased. He also raised the question of the narrow limits permitted in the analysis of pig iron. Mr. Bolton pointed out that their castings were for the motor-car industry and it was well known that in this trade there was a necessity for this. The iron used by them was always kept as near as possible to specification.

In answer to MR. JOHNSON, branch president, the lecturers said cupolas were hand charged.

MR. STANLEY asked whether resin-bonded cores could be baked in the same oven as oil-bonded cores.

MR. BOLTON said that they could. The only reason why it was not possible to use resin cores for the smaller castings was that they only had one oven and the oil sand cores in the small castings took longer to bake than the resin-bonded cores. The resin in use was a phenol-formaldehyde type.

MR. C. H. WILSON raised the question of the blacking of castings.

MR. BOLTON said that the resin cores were blacked by spraying with water containing the blacking. In reply to a further question from MR. WILSON, MR. FORD said that the tapered grinding wheel was used when no guard was in position when men were grinding castings. The taper was from the centre to the periphery of the wheel and if the wheel cracked the pieces did not fly about but were held in position by pressure until the operator had time to stop the machine.

THE PRESIDENT said that he had noticed during the lecture that Mr. Ford had said that dust was exhausted direct to the surrounding area, he wondered if this would be possible where a factory was situated in a built-up district. MR. FORD said that they were fortunate in their isolation; if they were in a built-up area some form of dust collectors would have to be used.

MR. VICKERS said he was particularly interested in Mr. Bolton's remark that no new sand was added to the conveyor system, and wondered how the fines problem was dealt with. He also wanted to know if a small pencil core was ever inserted into the runner and what was the weight of the runner in ratio to that of the casting.

MR. BOLTON replied that very little "fines" was removed by the extractors. His main difficulty was that there was not enough fines in his sand, he had trouble in maintaining the permeability at 50. With reference to the question about the runner ratio, Mr. Bolton said they had never been able to establish the ratio between the weight of the runner and the casting, the whole business was a matter of trial and error. With reference to the pencil core, he said that this was mainly used in steel-casting practice.

MR. ROBSON asked whether resin could be used for small cores. MR. BOLTON replied that it could and that small resin-bonded cores would bake in half the time taken by oil-bonded cores.

MR. G. W. WILSON proposed a vote of thanks to both speakers. He said that whilst he saw Mr. Bolton's point that their design and layout might not be suitable for many foundries in their area, he himself had found much that could be used and felt that all those present had done the same.

MR. BOLTON thanked the members for the very excellent hearing the Authors had received and for the very interesting discussion which had ensued.

Sheffield

At the opening meeting of the Sheffield branch of the Institute of British Foundrymen on October 2, Mr. V. C. Faulkner (past-president and honorary member of the Institute) was the recipient of a presentation from the members of the branch as a mark of their high esteem and of his service to the foundry industry and to the Institute. The presentation took the form of a stainless tea-set. In receiving the presentation, Mr. Faulkner mentioned that he regarded it as particularly appropriate in form as he had been the second person in this country to make stainless steel and he had been the first in introducing it into France. The proceedings of the meeting, which was highly successful, also included Mr. J. G. Bailes' Presidential Address on "Human Relationships in Industry" followed by a film entitled "In Step With the Times."

INDEX TO VOLUME 88

The index for Volume 88 of the "Foundry Trade Journal" covering the period January 5 to June 29, 1950, has now been printed and is available to readers on writing to the Publishing Office of the Journal, 49, Wellington Street, London, W.C.2.

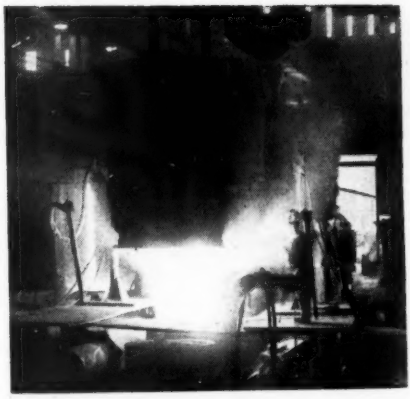
By arrangement, names and addresses of regular readers can be placed on a mailing list to ensure their receiving future indices as and when published. Normally, indices are issued a few weeks after completion of each volume, but this last one was unavoidably delayed by the dispute in the printing industry.

* FOUNDRY TRADE JOURNAL, May 25, 1950.

Massive Steel Castings

Production at the Parkhead Works of William Beardmore & Company, Limited

By A. R. Parkes



The steelworks of William Beardmore & Company, Limited, at Parkhead, Glasgow, specialises in the production of mass as distinct from mass-production. Steel castings up to 150 tons as poured, ingots up to 165 tons, and forgings of like magnitude are its basic commercial products, and the ancillary sections—machine shops, hammer forges, presses, slab mills and assembly shops—have been developed with these two linked-production units as their backbone. This works was among those visited by members of the Iron and Steel Institute during the recent special meeting in Glasgow.

FOUNDED IN 1835 by the purchase of Parkhead Forge by Robert Napier, who was later named by his contemporaries as the "father" of shipbuilding on the Clyde, the firm had early success. It built engines for the British Queen, the first steamship to cross the Atlantic, and rapidly established itself as a great engineering and shipbuilding enterprise. Napier was followed by other hardly less-well-known figures in the saga of those pioneering days when steel first replaced wrought iron. The names of William Rigby, his partner William Beardmore, who gave the firm his name, the brother, Isaac Beardmore, and the son, William Beardmore, later Lord Invernairn, will forever be linked with the history of epoch-marking developments of Clydeside engineering and shipbuilding progress.

During the first world war, the company numbered among its products over a million tons of steel (including 17,700 tons of Beardmore heavy armour plate, 24,000 tons of bullet-proof plates, and 11,000 tons of forgings), 120,000 tons of shipping, and 687,000 engine horse-power, as well as 650 planes (including 4-engine, 2,000-h.p. Handley Page's), millions of shells, and thousands of heavy guns. Airships and tanks were also produced. During that period, the weekly wage bill rose from £22,800 to £145,000.

In the interval between the wars, there were major changes of product and separation of interests. Locomotives took the place of gun production at the Dalmuir works, a steel foundry was laid down at Mossend for locomotive castings, and the head works at Parkhead concentrated on heavy steel forgings and castings (particularly ships' castings), a substantial tonnage of the former being in the form of marine-engine crankshafts. Additionally, steel-plate and section mills were kept busy at the Mossend and Parkhead works.

In the course of time the Parkhead works was separated from the shipbuilding interests and there began a long period of expansion of the forge, foundry and heavy engineering facilities which has culminated to-day in a group works at Parkhead occupying a site of over 95 acres. The late chairman, Col. Sir James Lithgow, Bart., was responsible for the more recent modernisation schemes and extensions, and the present chairman, Mr. Alex. Williamson, C.B.E., has ably continued the execution of the programmes involved.

Post-war Development Plan

Within the general framework of the first Steel Development Plan, prepared by the British Iron & Steel Federation in 1945, William Beardmore & Company, Limited, was the first of the 23 major steel-producing and finishing companies to complete its programme of rehabilitation and expansion. This included the entire reconstruction of its steel foundry at Parkhead so as almost to double its capacity both from considerations of weight per piece and total output. Since 1946, the patternshop also has been completely re-built and re-equipped. During the same period, the heavy forge-press shops have been re-arranged and the 2,000-ton and 4,000-ton presses re-built, the 6,000-ton press being itself fairly modern. Re-heating furnaces have been re-built and enlarged, and a new 100-ton forging crane has been installed at the 4,000-ton press, and new plant is being introduced for the production of fully-hardened forged-steel work rolls for use in cold-strip mills.

The illustration at the head of this article shows double-ladle teeming.

Massive Steel Castings

Although certain sections engaged mainly on wartime production have been re-trenched, the overall capacity of the machine shops has been increased, and many additional large machine tools have been incorporated.

Most recently, the scope of the jobs handled has been enlarged so as to include the complete building of finished heavy and lighter general engineering plant to customers' design and specification. Large rolling-mill installations and small printing machines providing examples from the extremes of size and illustrating the complexity of jobs in this category which at Beardmore's are built from start to finish.

Works Layout

Beardmore's Parkhead works is located in the eastern district of Glasgow, and is restricted, so far as new building is concerned, by being in a congested area. Like many old-established concerns, additions have been made from time to time, but the overall scheme is not disproportionate. The works is grouped mainly around the junction between Duke Street and Shettleston Road, both of which have double tramway tracks, a factor limiting the possibilities of overhead transport across the roads. On the north-west, the buildings are bounded by the branch railway line to Polmadie and on the north by Parkhead station on the main line to Edinburgh. The fact that the melting shop is on the west side of Duke Street and the foundry on the east necessitates carriage of molten metal across the road. One block of buildings, comprising mainly light machine and assembly shops, is situated to the north of the main line, leading off Rigby Street. The main offices and general laboratory are on the north side of Shettleston Road. Communication across Duke Street is by two rail crossings, that for hot-metal from melting shop to foundry being at the southern side of the works. Also, there is a tunnel beneath the street although this is only suitable for pedestrian or light-truck traffic. It is necessary to assimilate these ruling topographical details, before the limiting features and the stages in the development of the site can be appreciated.

The melting shop is at the southern side of the works, and is well served with looped branch railway sidings for the supply of raw materials, moulds, etc. Separate sidings and subsidiaries take metal and ingots to the armour mill forge-press (6,000 ton) and machine shops, adjacent and, additionally, across Duke Street to the foundry and the smaller forge presses, which are about 400 yds. away at their nearest points. Finished castings are despatched from the east end of the foundry. Most of the castings pass directly to a group of machine shops situated close at hand; in lesser degree others are distributed to secondary machine shops or for outside customers. The keynote is not so much logical straight-line development, but careful dovetailing of facilities, having in mind the requirements of tackle and the limitations imposed by the site. Notwithstanding all the difficulties, a flow-production pattern has been carefully worked out, movement is meticulously controlled and there is very little waste transport. Table I illustrates the works flow diagram by product.

Balance of production, so essential to a "mixed" production works of this size has been achieved by careful integration, planning and loading of the shops, keeping the emphasis on the foundry and heavy forge as the basic production units, and retaining the flexibility of production necessary in this post-war era.

Melting Shop

The melting shop, which measures 714 ft. by 177 ft. overall, is shown in plan view in Fig. 1; both foundry and ingot production being served from the same furnaces. An unusual feature in works layout has been previously referred to, namely, the

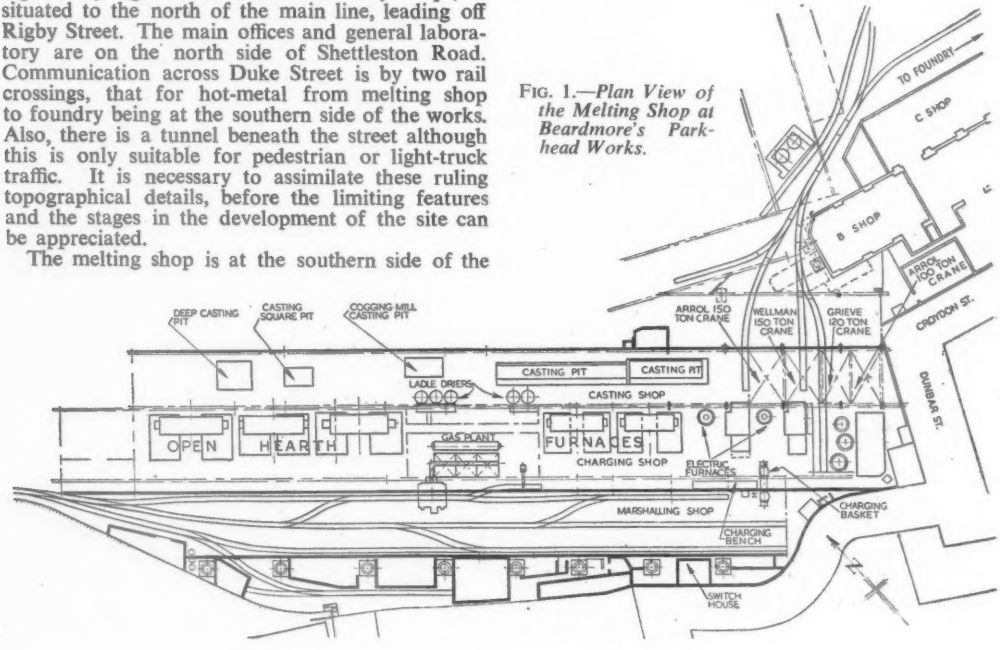
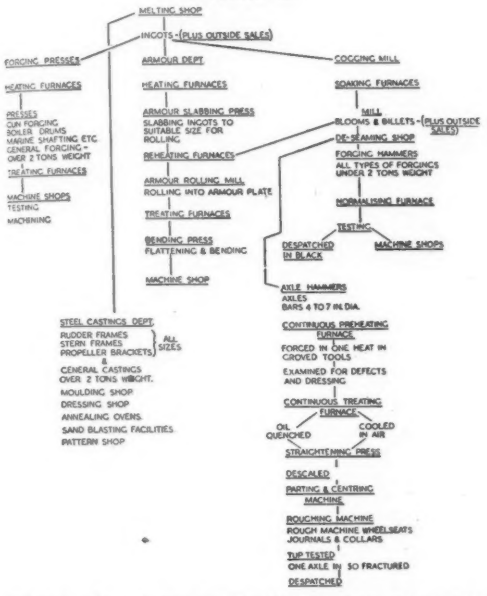


FIG. 1.—*Plan View of the Melting Shop at Beardmore's Parkhead Works.*

TABLE I.—*Works Flow Diagram and Main Productions.*



melting shop being on the further side of a main road from the foundry, necessitating the carriage of molten metal across the road. This is effected at the appropriate times on special ladle bogies carrying up to 60 tons of metal. The ladles are covered by a lid and have 14-in. bricked linings. The time required for tapping foundry metal, its transport to the mould, some 500 yds. distant, and for pouring occupies about 27 minutes overall.

The melting plant consists of five open-hearth acid furnaces of standard design and of the fixed type, three being of 65 tons capacity (at the west end of the shops), one of 45 tons and one of 35 tons. These are fired by raw producer gas from producers situated between the larger and the smaller furnaces. As is usual in shops of this kind, the furnaces are carried centrally on a raised raft running the length of the shop. The furnaces are served on the one side (south) by Wellman crane-type overhead ram chargers. On the other side is the casting pit shown generally in Fig. 2. Additionally, at the east end of the furnace raft are two electric-arc melting furnaces, one of 12 and the other of 18 to 20 tons capacity. Charging the open-hearth furnaces is by two 5-ton charging machines.

The electric-arc furnaces are used mainly for alloy steels or small heats. One, the 18- to 20-ton capacity unit, is an Efco " Heroult " of orthodox type and the other is of local design, with hydraulically controlled electrode gear.

Production Planning and Ingot Moulds

The fact that the ingot capacity of the shop varies from 30 cwt. to 165 tons, considered along with the foundry requirements, makes it necessary to plan charges for some time ahead. Only about three firms in Great Britain could undertake such an ingot range. Programmes are scheduled and meticulously timed at least one week in advance and a broad outline is prepared for 3 or 4 weeks ahead. The ingot-mould shop and store contains several hundreds of shapes and sizes each with its origin, history and life recorded. A 165-ton mould costs in the region of £4,000 plus about £700 for transport, so it is apparent how much capital is locked up in this one item of equipment alone.

The Ardeer Foundry Company Limited in Ayrshire supply the smaller ingot moulds (up to 60-ton capacity) the larger ones being obtained from Brightside Foundry & Engineering Company, Limited, Sheffield.

The melting shop is served by four tapping cranes, two of 150-ton capacity, one of 120- and one of 100-ton. The illustration at the head of this article shows the use of two ladles for teeming a large ingot. Temperature control throughout is by the Scholfield-Grace immersion pyrometer, and a Tinsley recorder. The foundry takes 150 to 180 tons of metal per week out of about 2,000 tons total melt.

There is a cogging mill adjacent to the melting shop which is operated chiefly to produce blooms and billets for hammer-forge production, the latter being largely for railway axles. It also produces acid steel blooms for sale.

Foundry

The foundry proper, where steel castings only equalled in size and weight from one other foundry in Great Britain are made, is shown in plan view in Fig. 3. It will be seen to consist of two parallel bays 750 ft. long, and 74 and 59 ft. wide (recently increased to 46 ft. high, to eaves), and running roughly east and west. The north bay is

FIG. 2.—*General View of the Melting Shop Casting Pit from the Furnace Raft.*

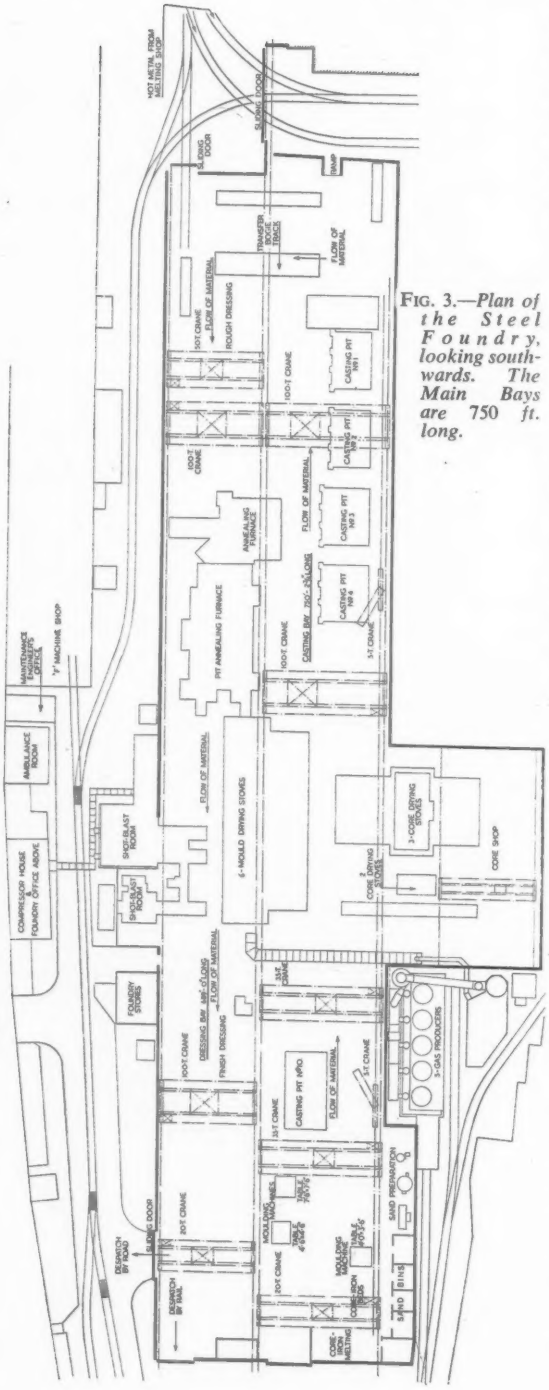


FIG. 3.—*Plan of the Steel Foundry, looking southwards. The Main Bays are 750 ft. long.*

devoted to moulding and the south to knocking-out, dressing and fettling. At the east end there is a small iron foundry for core-irons and grids, and along the outer wall of the moulding shop there is a sand-preparation plant, a core-making section and a battery of bogie-type core-drying stoves. Centrally, between the bays, are mould-drying stoves and annealing furnaces. These are fired by producer gas, but unlike the melting shop, cleaned gas is used in the foundry, the producers being situated on the north side.

For such large jobs as are generally undertaken by this foundry, pit moulding is practised and most of the operations are carried out manually by highly-skilled operators. There are two permanent moulding pits, with bricked sides, size 30 by 20 by 13 ft. deep which are used for the larger jobs such as rolling-mill housings which require up to 160 tons of liquid metal and 14 semi-permanent pits from 40 by 20 by 6 ft. deep, bricked to requirements. The pit depths depend somewhat on the shop water-level, normally at 14 ft. down; deeper pits need to be waterproofed. There are three moulding machines—plain jolters—with tables 7 ft. 6 in. square, 4 ft. 6 in. square and 4 ft. by 3 ft. 6 in. respectively. Fig. 4 shows a general view of the moulding bay.

"Moulders' Compo" is the main moulding medium due to its high refractoriness. It is a mixture of dead-burned and raw fireclay with plumbago, and is supplied, ready mixed, to storage bins at the east end. No ingredients except moisture are added to bring it to moulding consistency. The surface of a mould is made up of a 2-in. thickness of new "compo," and externally painted with zircon paint. Cast-iron core irons and grids are used in a variety of shapes and sizes. A 2-ton nominal capacity rotary, oil-fired melting furnace is used for core irons. Daily melts are made which for 35-cwt. charges take 4 hrs. from the cold. Due to their weight and size, cores also are mainly made in "compo"; they are liberally "ashed," that is, their interior is composed mainly of ashes to give adequate venting and easy "crushability." Cores are likewise painted with zircon before insertion in the mould. Some of the drawbacks weigh over a ton.

Floor moulds are dried by portable Pneulec units of the coke-fired, forced-draft type operating at 500 to 550 deg. C. The top parts of moulds, drawbacks, and cores are dried in stoves of the solid-bogie type with a winch-operated draw-out. These stoves are fired by cleaned producer gas. There are six stoves for top parts and drawbacks, four 10 by 20 ft., and two 20 ft. square, as well as five core-drying stoves, three 10 by 20 ft., and two 6 by 7 ft. A temperature of 450 to 500 deg. C. is used for core drying.

In the moulding bay are five overhead travelling cranes, two 100-ton capacity, two of 35-tons, and one of 20 tons. Of wall cranes, there are two of 5-tons capacity on the north side, and the core-shop has a 10-ton crane operated from floor level. From the moulding bay, castings are transferred to the dressing and fettling bay by means of a heavy-duty, winch-operated bogie.

Typical Moulding Procedures

So much of the production from this foundry is out-of-the-ordinary run both as regards size and shape, that it is considered worthwhile to describe in some detail the methods and moulding times applicable to certain typical jobs. The adjective "typical" is somewhat loosely applied, for the jobs vary so enormously that only by the imposition of vague categories, such as "large ships' castings" or "roll housings," can any job be regarded as typical.

Rolling Mill Housing.—The finished weight of this casting was of the order of 70 tons; the design was conventional, being 23 ft. 7 in. high by 13 ft. 3 in. wide by 24 in. deep and 6 ft. across the feet. A ladle weight of 91 tons of molten metal was required. Moulding commenced when the full pattern arrived in the foundry in sections and was assembled and set on its side in the pit by the patternmakers. It was supported on a bed of rammed "compo" 8-in. deep. Six skilled moulders, including a leading hand and with an unskilled helper in addition, began by ramming up the sides, reinforcing the jobs as they went along. A 2- to 3-in. thickness of compo was laid in contact with the pattern and backed up with floor sand and moulding was then continued up to the parting line. A parting was made with washed silica sand, a top-part box set in position by pins driven into the floor and moulding of the top section next commenced, the sand being reinforced by hanger irons from the box bars and special iron gratings wired into place. No separate centre core was required for this job, the pattern being such as to leave its own core. The top-part was then removed, turned over, "finished," and taken to the stove for drying. The pattern was removed from the bottom part, this part too was "finished" and, subsequently, dried with six portable units. Immediately after drying, the mould faces were painted, the residual heat in the mould drying the paint. After the dried top-part had been similarly treated, a "try-on" fit was made and checked by stamping in clay after obtaining a register with whitening.

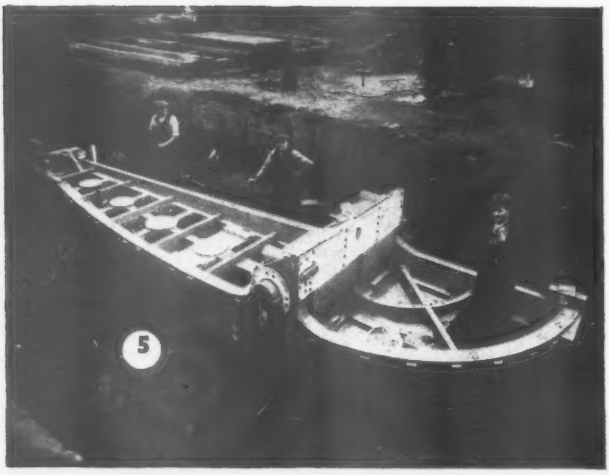
Finally, the mould was cleaned and closed, weighted with cross-beams and metal slabs to a total of about 100 tons, and poured. Step pouring, the normal practice for such jobs, was used, employing four 3¼-in. dia. downgates and eight ingates, 3-in. square, some at the parting line and others at the bottom. Feeding heads, 36-in. dia., to a total weight of 21 tons, were distributed, one over the centre boss and two over the feet corners. These were carried to about 4 ft. of metal above the job.

Metal was supplied in two 45-ton lots at a pretapping temperature of 1,630 to 1,640 deg. C. Two bottom-pouring ladles, each with two 2¼-in. dia. nozzles, teemed direct into the four downgates. No topping-up was carried out, it being usual to use electric-arc feeding on all such heavy jobs (see Fig. 7). For this purpose, refractory-lined covers with annular rings were put on the heads and graphite electrodes were swung into position from davits and winch gear and lowered to make contact with the molten steel. Arcs were struck at 1,000 amps. each at 90 to 100 volts, the arrangement being "earthed" by means of rods projecting into the base of the feeder heads. The duration of the arcing was determined by progressive checking of the solidification rate of the casting with dip rods. When measurement by dip rod indicated that the casting proper was solid, arcing was discontinued.

The casting was allowed to cool over a period of about eight days. No "baring" is practised at the foundry, reliance being placed on the collapsibility of the cores to relieve any shrinkage. At about 300 deg. C., the top was removed and the casting drawn from the mould and transferred to the rough fettling section. After digging out loosely-adhering sand and reinforcing irons, the risers were locally preheated to about 200 deg. C. by fires and then burnt off with oxy-acetylene. Before final fettling and dressing, the casting was fully annealed. Total moulding time for this comparatively straightforward job was three weeks; about 14 days were taken in rough fettling, 7 days for annealing and a further 3 weeks for final dressing.

Riveter Leg Arm.—Stages in the moulding and dressing of another large casting — a riveter leg arm, weighing 22½ tons. are shown pictorially in Figs. 5 to 9. The overall dimensions of this job are 27 ft. 2½ in. long by 6 ft. 10½ in. wide, maximum and minimum section thicknesses being 6 in. and 2 in. respectively. The following is the time schedule in weeks worked to on this job:—Patternmaking 3, moulding and coremaking 4, closing and casting 1, cooling 1, rough dressing 3, annealing 1 and, finish dressing 2, making a total of 15 weeks.

FIG. 4.—*General View of the Moulding Bay in the Foundry. Pit Moulds, closed and ready for their Runner Boxes, are shown in the foreground.*



Stages in the Moulding, Casting and Finishing of a Riveter Leg Arm Casting, weighing 22¼ tons.

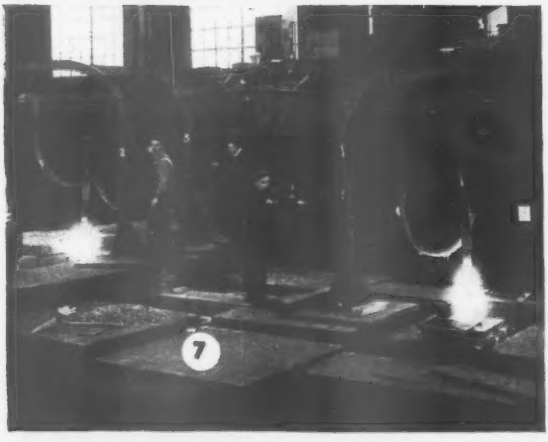
FIG. 5.—*Pattern bedded in a Pit ready for Moulding.*

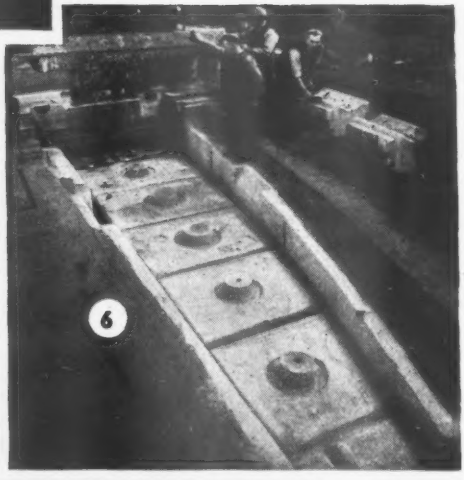
FIG. 6.—*Placing Cores in Position 21 days Later, before Final Closing of the Mould.*

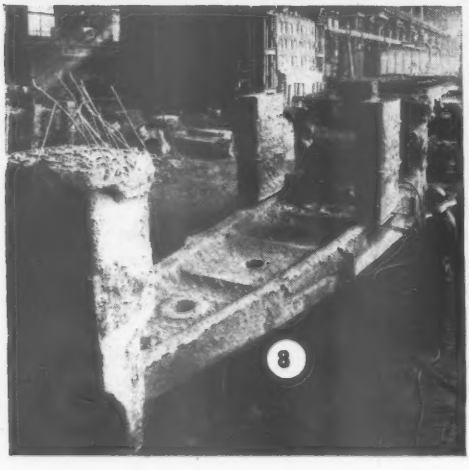
FIG. 7.—*Two days Later, after Casting. Electric-arc Heating is Utilised on Three Feeding Heads. Note the Heavy Weighting of the Mould.*

FIG. 8.—*Rough Dressing and the Removal of Heads by Oxy-acetylene Cutting 10 days Later.*

FIG. 9.—*After a further period of 14 days, the Casting is Annealed, Dressed and Finished Ready for Despatch.*







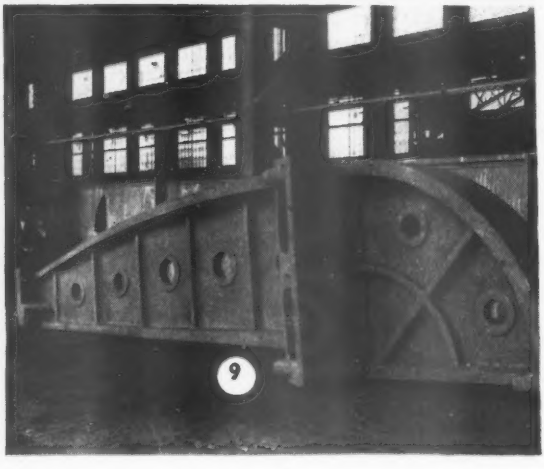


FIG. 10.—*Rough Fettling of a Rotor Spider; weight 11 tons 13 cwt., dimensions 11 ft. 1½ in. dia., by 3 ft. 4½ in. deep, excluding Feeding Heads.*

Stern-frame Castings.—Beardmore's have made the largest single-piece ships' stern-frame castings yet produced. These were of 45 tons finished weight, and measured 29 ft. by 23 ft. 9½ in. by 4 ft., with a 4 ft. dia. boss and a thick-to-thin section range of 18 to 2 in. Six weeks was occupied in moulding and closing these jobs. In the main, the pattern left its own cores, and many "lightening" drawbacks were used. Several frames of comparable size have been cast. That for the Queen Elizabeth, however, though also cast at Beardmore's, was a composite job.

Castings which are of large dimensions and have contrasting thick and thin sections, such as ships' stern frames, are moulded on a bed having a slope of 1 in 10, and are run from the upper end. This is to ensure rapid covering of the drag face with hot metal. Cores are sometimes fitted into "green" moulds so as to minimise adjustment after the mould is dried. A few loam-and-brick cores are used where practical, as these simplify the subsequent fettling. No internal chilling of heavy sections is used, although external metal chills are frequently used for promoting directional solidification. No exothermic feeding mixtures have been adopted; instead, reliance is placed on the electric-arc heating of heavy risers.

Weighting of moulds (from 200 to 600 tons) is used instead of tie-rods and bars. Joints are stepped to form "male" and "female" parts. Some top-parts, *i.e.*, flat or regular shapes, are produced by strickle moulding. Vent pipes are ignited when pouring. Moulding boxes are mainly of steel, built up of sections and with detachable bars; many are of very large area and are consequently awkward to turn over. Moulds are covered with sheet iron before the portable driers are used. Fragile patterns are weighted or pegged into the moulding pits to prevent movement during moulding.

For the majority of the work, plain carbon steel is used, but Wm. Beardmore & Company, Limited, make steel to any composition that may be required.

Fettling and Heat-treatment

Much of the work in the dressing of such large castings consists in the removal of loose sand, burnt sand, lifters and grids, all by the aid of pneumatically-operated chisels. Fig. 10 shows such operations in progress on a rotor "spider" casting, finished weight 11 tons 13 cwt.

After rough fettling, castings are annealed. For this, a new pit-type furnace with a slide-off roof has recently been built. This furnace is shown with its "charge" of castings and with the roof removed in Fig. 11. It is 40 ft. long, 20 ft. wide, and 12 ft. deep, holds approximately 200 tons of castings, and is heated by producer gas. The furnace is top fired by 18 burners and bottom draft is arranged. Annealing cycles vary from 26-hr. up to 60 or 80-hr. for a "lumpy" 80-ton casting. Charge make-up is grouped accordingly.

FIG. 11.—*Newly-installed Pit-type Annealing Furnace with the Roof Removed. Capacity 200 tons of Castings. Note the Firing Blocks along the Upper Sides.*

F

Massive Steel Castings

Alternatively, there is a bogie-type annealing furnace at floor level, chamber size 20 by 15 by 10 ft. high, side-fired with clean producer gas. This is of the recuperator type and also has bottom draft.

Both types of annealing furnaces have suspended roofs and cooling of their burden is regulated by roof control down to 100 deg. C. After discharge from annealing, castings are shot-blasted in a Tilghman's chamber-type plant, the size of the main chamber being 36 ft. square by 21 ft. high. Finally, they are finished dressed by hand tools, which practice involves cleaning or chiselling practically all over. Fig. 12 is a view of the dressing section, in which a number of finished castings are shown and identified, particulars of the major items being quoted in the caption. Cranes in the fettling shop include two of 100-ton capacity, one of 50-ton and one of 20-ton.

The foundry takes pride in accepting any design to be made as a steel casting, however large and complicated it may be. On receipt of a job at the blue-print stage, a consultation between the foundry manager, chief planner and foreman moulder takes place, and the method of patternmaking and moulding is decided upon. Reference is always made to the customer if it is considered that the casting could be improved by modification of design; this co-operation ensures the production of the best quality casting for the purpose required. Much planning in advance is necessary to keep a balanced loading in the shop, for as much as 500 tons or more of "work" may be on the floor at any given time. Over 100 skilled moulders are employed out of a total foundry personnel of about 250.

Patternshop

The new patternshop at Parkhead steel works was opened in July, 1946, and is one of the most modern in the country. A combined layout and erecting bay forms the central portion of the building. To accommodate patterns 20 to 30 ft. long, 10 to 20 ft. wide, and up to 15 ft. high and as many as six such jobs at a time, obviously requires much space, and the centre bay is 144 by 50 ft. by 22 ft. to the eaves. There are two 40-ft. wide side bays 155 and 133 ft. long respectively, 12 ft. 6 in to the eaves. A sloping site was utilised to provide a step of 4 ft. to the floor of the loading bay. The centre bay is carefully levelled and made of 3-in. by 1½-in. Oregon pine on 9- by 2-in. timbers mounted on concrete.

A 3-ton Morris overhead crane spans the central bay, the only other machine on this section being a 36-in. bandsaw. Grouped around the side bays are individual and portable benches, an 18-in. cross-cut saw, a 36-in. rip saw, a surface planer and a combination planer, all at the timber-preparation area. Elsewhere, there are two eight-speed lathes both about 12 ft. between centres, two 36-in. double-disc sanders and two additional 36-in. bandsaws, one 30-in. bandsaw (utilising saws which have become too short for the 36-in. machines) and another 12-in. rip saw. A second combined surface and thickness planer is located close to a large Wadkin "Universal" machine, at the end of the east bay.

Also in the east bay are the cloakroom (with washing facilities) and a room for meals. Lighting is by roof glass to about one-third of the floor area with glass-brick side windows. Heating, ventilation, and dust extraction have been considered together. The former is effected by low-pressure steam from gas-fired boilers. Nine fans, three in each bay, draw in fresh air and pass it through radiators (24 hrs. per day in winter). The main dust-extraction plant is connected to each machine in the shop except the disc sanders which have individual units. Wood waste and sawdust are separated and the former is sold. A piece-work system is in operation and the new shop has both a substantially increased production rate and a reduced cost per pattern as compared with the previous shop.

Machine Shops

At the Parkhead works there are nine machine shops, grouped according to the range of product. There are boring shops, steel castings shops, general, and testing shops. In one shop, jobs tackled range up to 100 in. outside dia., bore machining up to 60 in. dia. by, say, 50 ft. long; external turning in length up to 90 ft. and bore from 12 to 15 in. dia. Additionally, there is a lofty shop for gun-barrel heat-treatment for which the pieces must be quenched in the vertical position.

Typical jobs handled in the machine shops include Doxford marine-engine crankshafts of various sizes

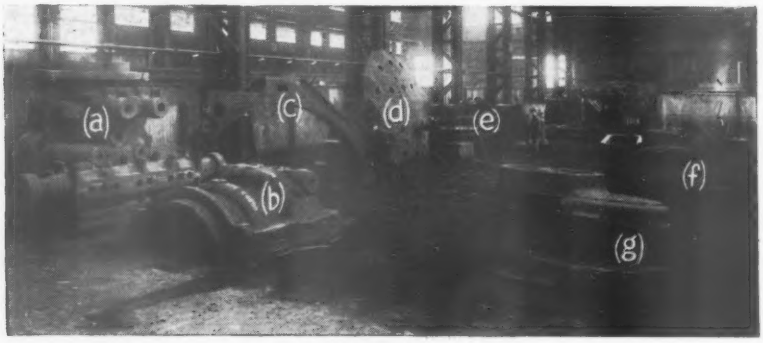


FIG. 12.—*Finished Beardmore Steel Castings.*
(a) Top Half of a Land Turbine Casing incorporating the Steam Chest, wt. 23 tons 15 cwt.
(b) Bottom Half of the Casing (a), wt. 15 tons 7 cwt.
(c) Half of Gate Valve Body Casting, wt. 12 tons 13 cwt.
(d) Gate Valve Door 13 ft. dia., wt. 17 tons 18 cwt.
(e) Forging Press Moving Crosshead, wt. 45 tons 6 cwt.
(f) Combined Crank Web and Pin, with Balance Weight, wt. 11 tons 10 cwt.
(g) Combined Crank Web and Pin, wt. 9 tons 10 cwt.

and weighing up to 104 tons (built up of shrink-fit forgings) open- or closed-end special hollow-forged boiler drums up to 60-in. bores and with up to 35 ft. parallel lengths (these weigh over 54 tons and are formed from a 165-ton ingot) turbine rotors up to a forged weight of 70 tons (Fig. 13) in special steels, with shafts and discs also are machined. A speciality is made of ships' castings and rudders, stern-frames and brackets for some of the world's largest ships have been both cast and machined at Beardmore's.

In the machine shops is probably one of the largest surface tables in the country. It measures 120 ft. by 50 ft. and is built up of cast-iron sections with T-slots, the whole being mounted on concrete. At times, this table has carried aggregate loads of 600 tons. Most of the castings produced in the works are rough machined or proved and many are finish machined. A large mill-housing casting may spend up to 4 months in the machine shops. Other large machine-tools include six planers, 16 by 40 by 6 ft. high to the bridge, with four horizontal tools and two side tools, one planer taking work 26 ft. horizontally and 18 ft. vertically, and two Keller die-sinking machines, one with a 6 by 4 ft. table and one 10 by 4 ft., both of the single-spindle type.

Laboratories

A large suite of laboratories fronting on to the main road was completed in 1941. These are in addition to the usual stage laboratories in the works. The total floor space is of the order of 22,000 sq. ft., and there is much equipment in excess of that used for normal routine work.

For example there is a combined bending-and-torque testing machine of N.P.L. design available. Sulphur printing is carried out on a scale quite outside the usual run—prints off up to 80-in. dia. discs are in routine production. An "ultra-sonic" unit, built by Henry Hughes & Son, Limited, for testing the soundness of large masses of metal has been arranged on a rubber-tyred trolley.

A 100-lb. high-frequency melting unit facilitates the manufacture of test casts to any analysis and the large battery of "creep" machines enables important information to be determined for complex steels at high temperatures under load. Fatigue testing, high-temperature short-time testing and many other investigations are daily carried out all to supply information to customers as the products are asked to meet more and more exacting conditions. Some examinations are carried out on large forgings to determine their soundness. This is in addition to magnetic testing, etc., which is done on a large scale.

The chemical laboratory follows the type generally associated with iron and steel works practice, and includes among its equipment, vacuum extraction equipment for hydrogen determination in steel. Much use is made of the Spekker absorptiometer for routine estimations.

Conclusion

In addition to the major schemes of re-building and re-equipment there has been progressive rehabilitation at the Parkhead works in smaller but none-the-less important directions. All the shops have been modernised, flow-production methods incorporated and layouts re-modelled to suit. Lighting is improved, both natural and artificial, and re-painting of all the shops is complete. Wherever practical, individual machine drives have been applied. Canteens have been extended and extra washing facilities and staff assembly rooms provided; a recent feature of this latter section of amenities is the institution of film shows of general interest. An air-conditioned conference room for executives has been acoustically treated and has 16-mm. film apparatus available.

Out of a total of about 3,500 employees, some 250 work in the foundry and about 100 in the melting shop. Foundrymen are paid day-work rates plus a bonus based on tonnage and time. There is no general scheme for apprentices, the works being in an industrial section where, by and large, son succeeds father as a natural sequence of events, and working at Beardmore's is part of the accepted order of things.

Acknowledgment

The Author thanks the directors and staff of William Beardmore & Company, Limited, for assistance generously given in preparing this article and the hospitality accorded during visits to the works. He is particularly indebted by Mr. D. Macmillan, who acted as guide and who assembled the illustrations.

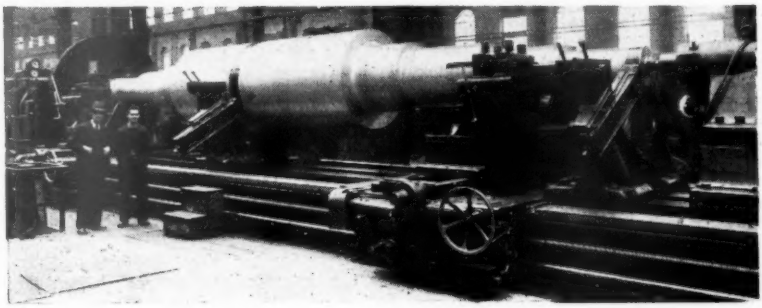


FIG. 13.—*Forged-steel Rotor Shaft in the Lathe; weight 60 tons, body dia. 52¼ in.*

Rationalisation of Sand Preparation

Discussion of Mr. J. F. Goffart's Paper

THE OFFICIAL EXCHANGE PAPER from *L'Association Technique de Fonderie de Belgique*, on "Rationalisation of Sand Preparation,"* by Mr. J. F. Goffart, was presented at the Buxton Conference of the Institute of British Foundrymen by Mr. V. Delport. The CHAIRMAN, Dr. C. J. Dadswell, explained that Mr. Delport was a little apprehensive about the discussion because he did not feel he was competent to answer questions, and then declared the meeting open.

MR. TIPPER welcomed the contribution from the Belgian Association, by Mr. Goffart, because he felt that a Paper of that type which should provoke a good discussion, would be helpful to them all. It was most unfortunate that one or two terms had crept into the Paper to which he took strong exception, particularly the term " grinding." As had been explained by Mr. Delport, it was a misinterpretation. Foundrymen all objected to the grinding of sand. Again, the term " reclamation " was wrongly used; it implied that they were treating something which had been thrown away, or rejected as useless material. That, he thought, was not the Author's intention; it was not sand " reclaimed," but sand " treated."

Tempering

Speaking generally, both a natural sand and a synthetic sand should be properly prepared before entering the moulding system; that was, before it went into a continuous-moulding plant. The best was not obtained from a new sand when it was put direct into such a system without treatment. The Author was really implying the same thing when he distinguished between a sand requiring a " grinding " type mill compared with a mixer required for preparing synthetic sand. The distribution of bonding clay was much easier with synthetic sand, hence a continuous-type mill could be used in spite of its speed of operation, and this was an important point in sand preparation on a continuous plant. Personally, he held the view that the important object in sand preparation, apart from distribution of the new bond, was the re-moistening or re-wetting of the dried bonding clay, usually referred to as tempering. This involved both chemical and mechanical action, which took time to perform, and therefore the stage in the cycle of operations at which moisture was added did need studying, and might vary for different plants. He felt the Author was correct in his selection of the points at which moisture should be added. He also agreed on the general suggestions for storing the moistened sand. These points had been well brought out in the Paper, and he thought there was very little with which British foundrymen would disagree.

Removal of Fines

MR. FLEMING added his compliments to those of Mr. Tipper, but there was one point where he feared he would have to disagree. The Author was looking at a rational system of sand preparation and included as one of his points the removal of the fines. It was a personal opinion that it was not a rational proceeding to attempt to remove fines from a moulding sand. He spoke particularly from the point of veiw of the ironfounder who had added coal dust and synthetic bonding material to his sand. From his own limited experience in attempting removal of fines he had found that one removed at the same time a far greater bulk of desirable colloids, and a valuable proportion of the coal dust. A more rational procedure was to so balance the sand for the particular system that the fines which naturally occurred were compensated by an original choice of sand grain size. By a definite addition of new sand to the old any loss of balance in the grain grading occurring in use was made good.

Wetting

MR. POLLOCK also thought the Paper a most interesting one. The question of wet sand had been most notably brought out and he wondered whether Mr. Goffart had conducted any experiments or had any data as to the rate of diffusion of the moisture. That was at the moment, he thought, rather bound up with the possible use of a wetting medium of such a surface tension that the rate of penetration was greater than with ordinary water. It seemed to have very wide implications from a number of points of view, which they had not time to go into in detail at that meeting.. For one thing, "wetting" could be coupled with the question of storage and it might conceivably be possible to reduce the amount of storage space necessary Also meriting joint consideration was the problem of hot sand and the possibility of using that hot sand or warm sand which normal founders did not like too much (and which was not so much a question of warm sand, as of having everything at the same temperature). In that connection, there had been published before the war in a German foundry journal a paper which dealt very fully with the subject of water penetration and the formation of agglomerates but unfortunately it was not available for him to quote from.

The subject of sand preparation was so vast that it was almost impossible for one man to cover it. It included geology, chemistry and engineering for the preparation plant. He thought that sometimes there was a tendency to forget that the design of the continuous sand plant should be looked at as a whole, not only for the direct provision of sand, but for all the intermediate stages which contributed to the mixing, including the turn-over and

* Printed in the JOURNAL October 12, 1950.

cooling effects. Crushing was a feature to which sufficient attention had not been given in this country. Mr. Goffart in the early part of the Paper had referred to the problem, but as far as his experience went it seemed enough attention was not given to the crushing of the lumps of sand as they came from the knock-out. Mr. Goffart referred to the use of large crushers. It would be very interesting to have some more information, if possible, on the type which he used, and just how crushing was incorporated in the system He was in agreement with the suggestion that the magnetic separators should be incorporated in the system in the manner described.

Another point which he thought had not been discussed or brought out in British circles was the question of water hardness. It seemed interesting. The matter was mentioned on page 4 of the pre-print and periodic control by hardness testing was suggested. That seemed to him to be a new point. He also asked whether Mr. Goffart had in his experience put in automatic water sprays in order to help in moisture distribution. He was thinking of integrated plants, and sprays regulated in relation to the quantity of sand which was passing.

Point to Add Water

MR. HIRD referred to the point in the sand preparation system at which water was added and said the matter was most important and could have a lot of unexpected results. There was an advantage in adding water at the knock-out as many of the lumps were then more readily broken down in the mill. This could reduce milling time and produce a softer sand. When the positon for the addition was changed, say, from the mill to the knock-out, the fine dust which normally escaped on the riddles and at the knock-out and belts did not get away and this could cause a sand which had been working satisfactorily for a considerable time with a good permeability suddenly to start causing scabbing and have a low permeability due to the fines being trapped in the sand by the water. Adding water at the knock-out was very convenient for operators on the plant, as it improved working conditions.

There was also the possibility of mixing the bentonite with water before adding it to the sand. This might enable a reduction to be made in the amount of bentonite that was being used.

Belgian Sand

MR. HAYNES said that being a practical man he had been in contact with sand for all kinds of castings and preparing sands was one of the most difficult of jobs, especially sand reclamation. The Belgians possessed a good natural sand which did not cause scabs, and was said to be the finest moulding sand in the world. It seemed therefore rather late in the day to be discussing what were the worth-while properties of such a sand. He only wished the sand was available in this country.

MR. COPE confirmed Mr. Haynes' remarks and added that he had been the interpreter for the Belgians when the sand was first imported. It was brought in for various foundries in consignments of 50 or 100 tons. There was only one thing to do with sand of that type, and that was to use it with care, and when knocking-out the casting, separate the dust and throw it away and supply the required amount of new sand to bring the bulk up to standard. A suitable rate was up to 90 per cent. of old sand and 10 per cent. of new sand.

MR. R. G. HANSON wanted to know if the Author could supply a little more information about the proposed method of removing the fines. Unlike Mr. Fleming he thought the removal of fines would have added importance as knowledge of sand propressed. He would like the Author's opinion as to the best time in the sand re-conditioning cycle for this operation of fines removal.

A MEMBER thought the Paper one of the most brilliant written in the past twenty years, giving basic information on sand treatment. As far as Belgian sand was concerned, or sand imported from Belgium, he would like to give them his experience. A foundry journeyman told him one day that he thought the best sand came from Mansfield. Before the war sand from Dresden was imported into this country and some said it was the best sand we could use. Now it appeared that sand was imported from Belgium to Britain, and *vice versa.* However, his opinion was that if the sand problem was tackled basically as in the Paper, sand produced in every country could be made workable for particular alloys and particular purposes.

Additions in a Sand System

THE CHAIRMAN said the reference by one of the earlier speakers to the use of sprays in making water additions reminded him that he would like to have the Author's views on the subject of the control of the process of making additions, not only of water, but of any additions that had to be made—of bentonite, coal dust and the like—to the moulding sand, particularly in a mechanised system. It would be very interesting to know the Author's views on the importance of the control of the accuracy of those additions and at the same time to find if he had any views on the implements or the machines or the parts of machines that might be used for making such additions, measuring the quantities in proportion to the total quantity of sand which was being manufactured.

Nomenclature

MR. DELPORT pointed out that he was not in a position to answer questions which had been put.

One point which had been raised in one or two cases was going back to the question of nomenclature, which was all the more difficult in translating from another language. In the case of the term "grinding" or rubbing, the Author himself took exception to the French term, which was "broyeur," and he said, on page 4 of the pre-print, that the designation of the grinding wheel was somewhat of a misnomer, since it did not grind in the true sense. So here was a case where the term applied to that particular mill required to be revised in the original language. In translation it was all the more difficult.

Rationalisation of Sand Preparation

A member had objected to the word " reclamation," but in the original Paper the Author merely called the machine sand plant. Finally, he thought the Author would be extremely happy to feel that apart from one or two points, the Paper he had contributed had met with such a measure of approbation and agreement.

Closing the session, the CHAIRMAN said he would, with their permission, propose a vote of thanks from the chair to the Author for the preparation and presentation of the paper. He was sure Mr. Delport would be able to convey to the Author the intense interest which the Paper had aroused and the Author himself would he was sure, be able to estimate the extent of the interest from the discussion taking place.

In addition a vote of thanks was due to Mr. Delport for reading and presenting the Paper in such an adequate manner.

The vote was carried unanimously and this concluded the session.

AUTHOR'S WRITTEN REPLIES

MR. GOFFART wrote his replies to the discussion in French, and what follows is a translation.

He warmly thanked the president and members for the indulgent and flattering reception which was accorded to his Paper dealing with some of the problems associated with foundry sands. He was very appreciative both of the high quality of the discussion and the obvious competence of those who took part. He also thanked Mr. Delport for his kindness in presenting the Paper.

Nomenclature

Though not specially competent in the English language, he believed he well understood what was intended by the questioners. It was, however, with some trepidation that he put forward the following remarks on some of the problems of English nomenclature.

The English word " mill " generally refers to the essential apparatus for the preparation of sands in a wider sense than the French word *broyeur*. The former suggests a rotary apparatus of multiple applications. and it did not seem incorrect to use it for meaning, in general, the machine used in the foundry. On the other hand, the French term *broyeur* straightaway implied in itself the idea of crushing—the destruction of the grain.

This term, even in its generally accepted implication, was therefore improperly used when it referred to the object that it seems to suggest to a founder. In the Paper submitted, however, he was not too happy as to the word " mill " being used by itself, for it was essential that a distinction should be made between an apparatus having a revolving plate and large rollers and a plant with a fixed pan and driven rollers. When the translator chose the word " grinding " mill, he made an exact interpretation of the French word " broyeur," but at the same time he also propagated the inappropriateness of the latter. He thanked Mr. Delport for having cleared up this difficulty.

In connection with the word " reclamation," which seemed to him to be correct, he found some confusion arose, as was pointed out by Mr. Tipper. Would " regeneration " be a better word? He agreed with Mr. Tipper that it was not the best practice to use new sand without preparation. Even admitting that this new sand was of the appropriate grain size and the clay content adequate, it was quite clear that the geological mechanism of sedimentation places the clay in relationship with the grains in a manner quite different from that required in foundry practice. Actually the plasticity of this clay is only developed by kneading or working in suitable apparatus.

The AUTHOR, however, disagreed somewhat with Mr. Tipper's statement that because the homogenisation of a synthetic sand was easier, one could employ a continuous-type mill. He, personally, believed that a batch-type mill was adequate for homogenising a synthetic sand and that *a fortiori* a continuous-type mill can certainly carry out the operation, with the added advantage of a large output.

Removal of Fines

Mr. Fleming's remarks were much to the point, and he explained the essential difficulty of the problem of the elimination of the fines. This problem is very complex and has so far been insufficiently investigated. The problem being posed in its general outlines, though somewhat theoretical, is the reclamation of all the moulding sand, even that which has been in contact with the metal. He believed that no satisfactory solution—economically speaking—had yet been found.

What should be taken out was the excess quantity of non-flocculent fines. All the fines should not be removed, but only the excess in relationship to the quantity required to assure easily-rammed sand, without dangerously lowering the permeability. A distinction should obviously be made from the fines purposely added, such as silica flour and powdered wood, other ameliorates and coal dust, which are all expensive materials; only those fines which arise from the breakdown of the grains should be removed. In the particular and rare case when silicon flour is systematically added to moulding sand, the solution is simplified, for it would be sufficient to regulate the input of new silica flour in relation to the fines existing in the sand.

Practically, the Author has actually found two possibilities—to envisage as lost the sand adhering to the castings—the chief source of fines—or allow that a desilting operation will remove, in addition to the silica fines, expensive material such as coal dust.

The solution suggested by Mr. Fleming, though practical, can only result in giving a false sense of security. It could keep the index of fineness of the sand constant, but it would not allow the percentage of fines to be kept constant. There would be a risk, in the long run, that sands with grains fragile under differential heatings would set up a dangerous fall in permeability.

No Suitable Plant

In reply to Mr. Hanson's question, a personal opinion was that no plant existed capable of solving

a problem for which not only the solution (as has already been pointed out) has not yet been found, but also which still was not exactly placed within practical limits. It would probably be necessary that all fine materials which ought to be eliminated should fall between clearly-defined degrees of fineness and that one should retain the material which was of a distinctly greater fineness. On such a principle, one could certainly construct a plant. However, it was not thought that there existed at present a machine for introduction into the cycle that would ensure an economic desilting in one single operation. The best time to actuate such a machine—if it existed—would be between the point where the sand, freed from foreign bodies, was reduced to the monocrystalline form and the point where water was added.

Distribution of Moisture

The Author was especially pleased with Mr. Pollock's and Mr. Hird's question, not unfortunately because he was able to answer them in a precise way, but because they stressed important and interesting problems which have not as yet sufficiently awakened the foundryman's interest. Was it not evident that an investigation into the rate of penetration of humidity into the sand and the control of this speed in relationship to that of water containing products acting on the surface tension would allow the reduction of the quantity to be put to work in a unit of sand? All the same, if one could, by adjusting the composition of the wetting agent, increase the vapour pressure, one could work with hotter sand, under the conditions, as Mr. Pollock said, that the patterns were heated. This was simple for a metal pattern, but not so easily accomplished with a wooden one.

The Author had, as mentioned earlier, used a hammer mill for breaking up mould lumps. He believed all plant of the centrifugal or percussion type would serve. It should be sited immediately after the knock-out and could advantageously be fed by a vibratory conveyor.

Hardness of Water

He had had his attention drawn to the question of hard water in a foundry where defects appeared due to the lack of refractoriness in the sand. Chemical analysis revealed an excess of lime which could not arise from the sand itself. He had thought of a *hydrotimetric* (water-hardness testing apparatus) examination, which provided the clue to the mystery, following a talk given by the late Mr. Girardet at a meeting of the *Association Technique de Fonderie* in Paris in 1943. The Author was not aware if this Paper had ever been published.

Stage for Addition

The Author thought the addition of water ought to be made in two stages, and one portion of the water ought to be present (in the major quantity at least) before storing so as to allow of slow absorption by capilliarity. The second addition should be made to adjust the quantity in the mill, even if it only compensated for the losses by evaporation during the passage of the sand through the sieve. Yet he did not think that it was necessary to make the primary addition at the knock-out for the reasons given by Mr. Hird, and in spite of the advantages which would be bestowed upon the hygiene of the foundry. Thus, the first addition of water should be made immediately before the storage bins.

The use of flocculent bentonite assuredly introduces an economy in use in comparison to when added dry in the actual mill. Usually, insufficient time elapses between the addition of the dry bentonite to the sand and the ramming of the latter in the moulding box for the colloidal properties to be fully developed.

Continental Sand

The Author was in full agreement with Mr. Haynes and Mr. Cope as to the excellent properties exhibited by Belgian sands. However, economic considerations apart, it is possible to build up synthetically a sand of equal quality, providing it is possible to obtain, initially, silica grains of sufficient variety, size, shape and purity. As to the anonymous speaker, he shared wholeheartedly the opinion expressed in the latter part of his discussion. Unfortunately, he was not so sure as to the truth of the first part. In conclusion, it was perhaps unnecessary to add that his services were at the disposal of the Institute further to add to the discussion if necessary, and he would be happy to reply in detail on any point which specially interested one or other of the members.

National Foundry Craft Training Centre

Mr. Forbes-Baird has sent us copies of four letters received from ex-students of the "Centre." Curiously enough, they all use the adjective "wonderful" to praise the various aspects of their life as students. In some cases it is the hostel, in others the nature of the tuition. This is very different from some of the earlier reports received from the lads, and is most gratifying to the trustees and to the industry in general. We append below the proposed courses for 1951. We commend these for the careful study of foundry executives for the continuity of the Centre depends upon the intake of fresh lads. Mr. Forbes-Baird, whose address is 117, Church Lane, Handsworth Wood, Birmingham, 20, will be happy to provide the fullest details as to the cost and facilities provided.

Proposed Courses for 1951

Term No. 23, Course 2: Commence January 1, End January 26; Term No. 24, Course 3: February 5, March 2; Term No. 25, Course 1: March 12, April 6; Term No. 26, Course 2: April 16, May 11; Term No. 27, Course 3: May 21, June 15; Term No. 28, Course 1: June 25, July 20. Term No. 29, Course 3: August 13, September 7; Term No. 30, Course 2: September 17, October 12; Term No. 31, Course 4: October 22, November 16; Term No. 32, Course 1: November 26, December 21. Term No. 25 includes an Easter break on March 26 and 27 and between terms 28 and 29 there is a three-weeks' vacation.

VOLUNTEERS FROM the main London office of British Insulated Callender's Cables, Limited, were recently called on by a blood-transfusion collection service. Of the 111 volunteers, 92 were accepted during the day and each gave ⅓ pint of blood. Only ¼ hr.'s break from normal routine was required for each donor.

German Foundrymen's Association

Annual Meeting at Dusseldorf

THE ANNUAL GENERAL MEETING of the *Verein Deutscher Giessereifachleute* (German Foundrymen's Association) was held in Düsseldorf on September 22 and 23. During its 41 years of existence, the association has created a strong bond of fellowship amongst all German foundrymen. Greetings to foreign guests were expressed by the Lord Mayor, J. Gockeln. The following paragraphs are abstracted from the inaugural address.

The extent of the task of the V.D.G. is shown on considering the ratio between the total tonnage of castings and the total tonnage of pig-iron produced. In 1939, the production of pig-iron attained 7,140,000 metric tons, of which the foundry industry used 1,676,493 metric tons to manufacture castings. This is approximately 26 per cent. In 1949, 328,056 workers were engaged in the iron, steel, and ironfoundry industries, and of this total, 102,708 were employed in the iron and steel foundries. That is, an average of 30.7 per cent. In the non-ferrous field, 59,375 metric tons of light-alloy and copper-base castings were made in 1949, this section employing approximately 50,000 workpeople. Thus, the foundry industry provides employment for about 150,000.

To a certain extent, Düsseldorf can be looked upon as the centre of the foundry industry, especially the "*Haus der Giesser*," (Foundry House) expected to be completed during this year. It is located near the Hofgarten.

The main meeting was well attended by visitors from Germany and abroad, and the most noteworthy work of the various divisions was emphasised. Some of the Papers presented are given in abstract later.

The comments of Dr. Ing. E. Hugo, of the "*Fachausschuss für Nachwuchsförderung*" were outstanding. He spoke on "Aims of Education for Apprentices, Foremen and Engineers of Foundries." He specially referred to the training of youth so as to provide a generation capable of bringing about a steady development and a sound expansion of this industry.

Concluding, Professor Dr. Wilhelm Hische gave his comments on the ethical relation of the working man with his industry in the lecture "Man, at Work in the Factory."

EXTRACTS FROM THE PAPERS

"Extraction of Sulphur from Cast-iron" by Dr. Carl W. Pfannenschmidt (Ironfounding Division).

The use of pure or molten soda in the shape of a soda slag is well known, but the use of these methods is not very favourable because the slag formed is of such a character that small inclusions are often poured into the mould together with the molten metal. This slag might then be deposited in the casting itself. It is therefore necessary to obtain a slag at an adequate extraction of sulphur rate, which guarantees harmless separation without a further reaction with lime. In addition, it is disadvantageous that the pouring temperature during the time of the filling of the ladles should be too high. Extensive experiments were carried out with the co-operation of various firms, because it was discovered that, besides an adequate composition of the sulphur-extracting material, even the refractory linings of the ladles were an important factor. Ladles which were lined with ganister or fire-brick give a sulphur extraction of approximately 40 to 45 per cent. A change of the ladle lining to basic, or better, neutral materials, resulted in an immediate increase of sulphur extraction. Also, the actual technique of sulphur extraction was of the utmost importance. The poorest method was the charging of the soda ash on to the bath. The spreading on the bottom of the ladle was more favourable and, still better, the installation of a special dripping attachment which resulted in a stirring of the bath. During this process observations could be made regarding a possible effect of gas treatment on cast iron.

"Material and Work—Review and Outlook," by Dpl.-Ing. G. V. Schmidt (Steel-casting Division).

The steel-castings section, after reconstruction in 1947, continued the work which was started before the war. The programme for the year 1950 was elaborated on January 27, 1950, at a technical committee meeting held in Düsseldorf. The questions discussed at this session and the problems which will have to be solved are of common interest and the following spheres will again be explored.

(1) Development of moulding sand for higher efficiency.

(2) Use of synthetic moulding sand for steel castings.

(3) Production methods for making steel castings true to dimensions.

(4) Development and composition of steel castings for wear resistance.

(5) Tests of machinability, particularly of the harder varieties of steel castings; influence of acids, carbides, sand inclusions, shrinkholes, etc., in order to provide reliable design data.

(6) Mechanical wear of steel castings.

(7) The influence of sulphur on the strength of steel castings.

(8) The influence of phosphorus and sulphur on cracking.
(9) Welding of steel castings.
(10) Moulding and castings technique; considering their related influences.
(11) Use of steel shot, its influence on economy, and its effect on the cleaning of steel castings.
(12) Examination of the use of the high-pressure water-cleaning method on steel castings (in order to obviate silicosis).

In addition to the above, there are still subjects which go beyond the framework of the Steel Castings Division; but which are of utmost interest in steelfoundry circles. The use of oxygen in the small converter and in the electric furnace are urgent problems. In the meetings of the Division there are to be current reports on the experiments with oxygen, as well as on metallurgical questions and melting equipment. Part of the questions raised will be solved with the help of the scientific institutes. It is one of the special tasks of the Division to bring about a gradually increasing co-operation with designers.

In the field of chaplets and cooling spirals a considerable success has already been recorded. Moreover, a summary of articles and reports concerning the use of cooling spirals and chaplets is available at the head office of the V.D.G. The technical progress abroad was for many years unknown in this country owing to war conditions. The Division is trying to bridge this gap as soon as possible. The Division intends to give its members an idea of modern works abroad by means of detailed lectures. Co-operatively, discussions on literature will be held and, later this year, the chapters of a very interesting book "The Metallurgy of Steel Castings" will be discussed in full detail. In addition to that, members of the Division will report on their experiences gained abroad a year ago.

Information on Malleable Casting, by Dr. Franz Roll (Malleable Castings Division).

The manufacture of malleable castings and, still more, the analysis of their properties and the utilisation of data for practical use for the consumer requires especial care. Besides scientific investigation, the malleable casting technician, in his daily life, should always be able to refer to the work of this Division for the solution of his problem. The recently-issued specification D.I.N. 1692 on malleable is the outcome of the work of the malleable technician and is, moreover, useful to the consumer. Owing to the fact the specification so far includes only statistical data, further work on properties must be undertaken, and amendments will be necessary. In the course of time, it has been ascertained that the dynamic stability of the material, and especially the retention of shape, has shown real superiority over other materials. Therefore, experiments will be started to investigate the dynamic properties of white- and black-heart castings. Also, the question of raw materials is of utmost importance for the manufacture of high-grade malleable castings. In this field, also, the work shows the importance of co-operation within the industry. Moreover, the application of correct raw materials requires quite new techniques. Therefore, the first contributions to the general information scheme have been published. A lively response from the consumer is expected. There will be a second book on the welding of malleable castings, from which the consumer will be in a position to learn the best type of structure malleable castings should possess. Additional information published includes soldering, hardening, and surface-treatment of malleable. These "Merkblätter," or data sheets, are intended for the consumer, in order to enable him better to understand the properties of the material. In addition, the Division for malleable casting will also deal with other raw materials, *e.g.*, hematite ore for which quantity, composition and workability properties have been set out. The publication of this "Merkblätt" is expected in the near future. It is worth mentioning that the tensile-strength test has again been reconsidered, in co-operation with the committee on standards.

Influence of Elements on the Properties of Cast Iron, especially the Thermal Stability, and on the Wear-test Results for Steel Castings, by H. Timmerbeil (Testing Division).

A survey of the compositions of iron used up to now for air-heating tubes, as well as an indication of the work done, has been given. The main work of the Division is the examination of aluminium/silicon/iron and chromium/silicon/iron alloys of 1.85 per cent. Cr, 5.35 per cent. Si, 0.54 per cent. Mn, and 0.57 per cent. P and 4 per cent. Al. At a temperature of 1,000 deg. C. and a duration of 100 hours this metal has a better thermal stability than chromium/silicon/iron alloys of 3.04 per cent. Cr, 3.74 per cent. Si, and 1.34 per cent. Cr at a temperature of 900 deg. C. The hardness of the aluminium/silicon/iron alloy meets the requirements, and the foundry properties are extremely good. In the technical press, an alloy consisting mainly of nickel and molybdenum has been recommended in order to reach a further improvement especially in heat-resistance.

High-grade Special Bronzes, by E. Weisner (Heavy Non-ferrous Division).

What are "special bronzes"? In specification D.I.N 1718, tin-bronze, special bronze, red brass, brass, special brass, copper-ingotting alloys, copper castings, are being defined by copper contents of at least 60 per cent. In connection with them it is found that practically all technically-valuable elements are included with the exception of zinc.

The collective conception "special bronze" is again divided into separate sections, *e.g.*, aluminium bronze—a bronze composed of aluminium and other elements, lead bronze, beryllium bronze, manganese bronze, silicon bronze, silver bronze, etc. Often one encounters other names of "trade" significance. In detail, aluminium bronze has been considered as being a binary alloy with substitution Al contents of 4 to 10 per cent. and bronze composed of aluminium and other elements, and elements in connection with Cu and Al mainly Ni, Fe and Mn. Aluminium bronze can be used as a casting alloy but only with difficulty, because

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it has relatively poor running qualities, forms froth during casting, produces an oxide-containing skin on the melt, and has considerable shrinkage and therefore increased liability to shrinkholes. The noteworthy advantages are increased strength as compared with copper-tin alloys (practically double) and the same resistance to corrosion in most cases as pure tin bronze. In addition, this group of materials can be used in the wrought state, thereby increasing their toughness. Other bronze castings in the field of " special bronzes " are lead bronze and lead-tin bronze. Binary lead bronzes are only applicable on backing components as their internal strength is insufficient. Backing is manufactured out of material similar to red brass or from steel. Lead-tin bronze requires no support as the internal strength of the material is considerably higher, owing to the contents of tin. Hardenable alloys based on copper/nickel/silicon show good corrosion and acid resistance. Manganese bronzes with manganese contents up to 1.4 per cent. are mainly used as high-strength material in heavy and light engineering, but also for screws and springs with good resistance to sea-water attack. Silicon bronze is outstanding owing to its high resistance to corrosion and good resilience. When centrifugally cast, the strength properties show a noteworthy increase as compared with the sand-cast variety. By hot-drawing the strength of the material can still further be increased.

Development of Standardisation in the Foundry Industry, by A. Knickenberg (Standardisation Section).

Standardisation means simplification—sectionalising—limitation, and, therefore, a review from the production of a single article to mass production associated with a considerable reduction of the production costs. It is the task of all engineers and designers to support standardisation, first, by positive contributions, and secondly by the exclusive use of standardised parts, because the most efficient standardisation will not be successful if the customer supports firms marketing non-standardised goods. The responsible body for this work in Germany is the Standards Committee *Normenausschuss* (D.N..A.), situated in Berlin and Cologne. It is supported by a vast number of sub-committees in which experts are endeavouring to produce satisfactory specifications. The standardisation side for the foundry industry is being dealt with by the foundry sub-committee (G.I.N.A.). With the revival of standardisation matters in August, 1948, this committee was founded by the initiative of the V.D.G. in co-operation with the national body. Since that time G.I.N.A. has already completed a number of specifications which have been published in *Die Neue Giesserei.*

Nodular Cast Iron, by E. Piwowarsky (High-duty Iron Section).

Pictures of the structure of iron castings in the as-cast condition were exhibited showing nodular graphite. In view of the great advantage of this type of graphite in the iron matrix, systematic experiments on nodular cast iron have been carried out, mainly in the United States, England and Germany during the past decade. It has been found that by adding cerium or magnesium, in connection with other elements, to the molten iron before casting, the required spherolytic formation of the graphite was secured. Noteworthy pre-requisites are established compositions as well as a low sulphur content. The adding of various elements, especially magnesium, is carried out by pre-alloying, by which contents of 0.04 to 0.08 per cent. Mg in the bath must be obtained. To meet the carburising effects of magnesium, the compensating effects of the silicon content will have to be considered in reaching a favourable crystalline structure. Nodular-graphite cast iron can be manufactured in all foundry furnaces, but it will have to be taken into consideration that the cast iron produced in the cupola demands a greater quantity of additive alloys to overcome the higher sulphur content. A short annealing of the castings at a temperature of approximately 900 deg. C. will effect the graphitisation of the mainly white and thin sections favourably. Owing to the high shrinking of this type of cast iron (approximately 1.4 to 1.8 per cent.), the moulding technique and gating will have to be adapted to be similar to those of malleable castings. The properties of nodular cast iron are extremely good. Tensile strength up to 85 kg.mm.^{2} (54 tons per sq. in.) at a ductility of 2 to 6 per cent. can be obtained without difficulty. By proper annealing, an elongation of 12 to 20 per cent, a high impact strength and a tensile of the order of 50 kg. per sq. mm. can be reached. Thus, it is now possible to produce iron castings—considering also all other outstanding properties—at both room and elevated temperature which will behave like steel.

Aim of Education for Apprentices, Foremen and Engineers of the Foundry Industry, by E. Hugo (Education Division).

In his lecture Dr. Hugo gave a summary on the work of the Education Committee within the V.D.G. He recalled the various problems which arise when considering the theoretical and practical training of apprentices, foremen and technicians. The real dearth of young people applying for training in the foundry industry which existed until the promulgation of rate reform was then overcome by extensive propaganda and by co-operating with the trade advisers in all labour offices. It is interesting to note that the same difficulties of getting apprentices for the moulding trade also exist abroad. The training of an adequate number of apprentices for the foundry industry has been guaranteed by the establishment of local technical classes which are being organised by the trade schools. In these schools, the apprentices receive only a theoretical training. In order to foster the basic practical training in the foundries, the V.D.G. have helped by publishing suitable technical books. Particular care is devoted to the training of foremen and, therefore, special courses have been initiated by the V.D.G. in industrial centres. There the foremen will study for four terms the practical and theoretical

(*Continued on page* 459)

Castings versus Weldings

Mr. F. E. Tibbenham's Inaugural Address to London Foundrymen

ON BEING INDUCTED into the chair at the opening meeting of 1950-51 session of the London branch of the Institute of British Foundrymen, Mr. F. E. Tibbenham delivered his presidential address in the course of which he said:—

Mr. Wilson and gentlemen. Much has been said and written around the alleged competition between castings and weldings, but my purpose in re-introducing this somewhat thorny subject into an address which should be non-controversial, is only by way of illustration.

I have two other excuses for selecting the relations between casting and welding as my example to-night. One is that the subject is topical; the Institute has in the recent publication of the reports of its technical sub-committees 23 and 26 brought into the open the techniques available to founders for using welding to make good certain of their defective castings. By giving these techniques official recognition and by the issue of such provisional codes of practice, a great step forward has been made towards the rationalisation of such practices. Secondly, the firm with which I am associated for many years has been sitting, as it were, on both sides of the fence. As manufacturers and exponents both of castings, and materials for welding, my company has had perhaps a unique opportunity for observing the impact of welding on the foundry industry. Sales records of welding materials to well-established founders and engineers in aggregate themselves constitute evidence of growth of the process. Competition of weldings with my own company's foundry productions has been experienced and its possibilities gauged. Trends of methods of manufacture among customers have been carefully followed and studied from both points of view.

Now that it is possible to view the relationships between welding and foundrywork with some degree of perspective, I am attempting to prove by analogy with welding, how new processes, ideas and methods, initially thought to be world-shattering, find their rightful level in the overall scheme of things, without constituting any serious threat to a well-integrated industry. The foundry industry is now so large, has so many ramifications, and is so based on sound functional economy that new industries prove but to add to or diversify its products. Small inroads into the spheres of activity of some sections of the industry will doubtless be made from time to time by competitive materials, but by and large, our industry by its strength has shown itself proof against major switches.

Historical Example

A retrospective glance is necessary to see with what needless apprehension weldings were viewed by foundrymen. Unfortunately, the lack of statistics for our industry makes it difficult to quote figures. It is impossible for instance to find any data which would reveal in quantities the true effect of welding on the foundry industry over the last quarter-century. Twenty-five years ago, however, and even quite recently, very real fears were expressed in certain quarters that castings would die out altogether. In the opposing camp, claims were made that the founder was quite a back number in the new welding era. Such presumptions as now seem amusing were made in all seriousness. Our own branch of the Institute was itself concerned, though perhaps not as seriously as the last sentences might infer. In 1939, at a mock trial in joint session with the Institute of Welding, our witnesses and "learned" counsel rose to great eloquence of self justification (or perhaps it was to drown a nagging fear) explaining the virtues of castings to the confounding of weldings. The verdict however, implied separate spheres of interest. Proof of the replacement of some large castings by weldings is contained in a memorable "Edward Williams" lecture, but four years ago. Sir Claude Gibb then drew a real and quite disturbing picture for a heavy section of our industry in relation to welding. (Incidentally, like a voice then crying in the wilderness, he used these examples to point the need for improved foundry conditions.)

Present-day Facts

It may be reassuring to see to-day how unnecessary it was to worry over those original gloomy prophesies. In spite of a mushroom growth represented in some industries, notably that making heavy electrical plant, the foundry industry in the same period has gone from strength to strength. It is of interest that I have been able to obtain the following information:—

(1) One of the largest electrical concerns in this country reports an overall change estimated from 55 to 75 per cent. of weldings against castings.

(2) In their "heavy-electrical" department it is actually 85 to 95 per cent.

(3) Despite all this and notwithstanding the increased foundry capacity, their foundry still remains a bottleneck and more and more castings are required. The character of these castings, however, has changed in the direction of mass-produced items, such as motor end-shields and small frames, large and one-off items are now seldom produced as castings. It thus proves my contention that these welding are actually assisting to increase the foundry output.

In ironfounding alone, current production is running at an annual figure of 3.500 000 tons representing an average yearly increase of nine per cent., since the war, or a gross increase of a million tons per year in 1950, as compared with 1941 when reliable statistics were inaugurated. In the steel-consuming industries, and it's not too big a jump

Castings versus Weldings

to assess founding on comparable terms, recent figures have shown increases, in 25 years, of mechanical engineering 3 times, electrical 5½ times, aircraft and automobile 6 times, colliery equipment 3 times and hardware 3 times.

If we could only visualise this upward curve of industrialisation on a general scale, with its ever-increasing demands on our own industry and then extend our views into the future, we should see our puny efforts to-day as through the wrong end of a telescope. We should then realise how to assess as the merest ripple the impact of welding on the whole.

Implications

That method, too, can be used to assess other innovations which at one time or another threaten the markets for castings. Powder compacts; the advent of plastics; the development of ceramics, in-roads of precision castings and problems of nodularising—all as competitors in one field or another, have lately been viewed by founders with some apprehension. My own firm finds a certain potential threat in the manufacture of cheap non-ferrous die castings, to the detriment of established markets for iron. Yet all these, when viewed like weldings in proper perspective, will, I am convinced, fall each into a well-defined place and make the foundry industry stronger over-all as a result of their coming.

Competition as an Incentive

Now, lest I could be accused of complacency, let me expound what I consider to be the moral of the story. It is not *threats* we must magnify but the *stimulus* which is implied. After getting a potential rival into proper perspective, one must use it to profit. New horizons must be opened up in place of a threatened or a closed market. A product must be improved or new outlets sought. Such a threat must be a spur to greater endeavour, an incentive to higher productivity, an urge to more stringent anti-waste campaigns or as a necessity to mother further inventiveness. If to-day competition from die-castings or to-morrow from plastics are our individual headaches, they must be countered by more-uniform sand castings which are efficiently produced, more easily machinable, cheaper and of improved appearance. Changes of conditions must be met by versatile outlooks—a study of all the expanding long-established concerns teaches that each has survived and thrived by continuous adaptation to new surroundings. Merely to oppose an improved but less palatable method is moral blindness and it is moral cowardice not to accept the challenge implied.

An increase in this pioneering competitive spirit in the foundry industry will raise the status of every one of us. It must be emphasised at Institute meetings; our productivity team has shown the way—and it is not mere copying the Americans which is required. The right outlook can be incorporated into managements, but it must infect enthusiasm into the rank and file and breed inspiration among the youngsters. Who knows, it may even filter through to the bureaucrats!

In conclusion, gentlemen, if I have planted a bit of this enterprise into my audience to-night and like a good farmer can manure it a little by any services during my term of office, I shall feel justified in having accepted the honour done in electing me to follow such worthy footsteps. Finally, if the big event which this talk represents in my life is sufficient to leave but a ripple when viewed by you in perspective, then, like with the advent of weldings, I feel sure my tenure of office will be accompanied by the production of more and more good, saleable castings.

Vote of Thanks

MR. F. ARNOLD WILSON proposed a vote of thanks to the president for the address and said he was impressed by his courage in choosing as his subject one of the most vexing questions in the Industry at the present time; furthermore, he admired him for having erected an "iron curtain" against any discussion of the "pros" and "cons" which he had put forward. What the branch had undoubtedly gained, continued Mr. Wilson, was a strong indication of the vision which the president possessed concerning the real need of the fighting spirit which was never more necessary within the industry than at the present time.

MR. B. LEVY seconded the vote of thanks. The address, he commented, told its own story, and without doubt the president had succeeded in putting his listeners on their toes.

Publication Received

Simplification in British Industry. Published by the Anglo-American Council on Productivity, 21, Tothill Street, London, S.W.1.

For several decades it has almost been axiomatic in manufacturing circles that simplification, be it by reason of the number of types made, or in matters of design, enhances productivity. An earlier publication has printed the report of a visit to the U.S.A. by a team of industrialists and this one gives an account of some of the results consequent upon the report. For instance, one of the largest manufacturers of gas cookers has recently made a drastic simplification of the range of cookers produced, with dramatic effect upon production costs and wages. The range of cookers has been reduced from 33 different types, sizes and finishes to one type only in a single finish, with four hot-plate arrangements as the only variants. Such striking concentration has an important bearing on costs and prices and the company is now able to produce and sell this model 32 per cent. below the price of a cooker of similar size and finish previously manufactured.

The reviewer would here state his views that this simplification can be overdone. It is too much like putting all your eggs into one basket. A speciality or two, plus a wide range of customers in an equally wide range of industries is a safe basis for many manufacturing concerns.

PRODUCTIVITY TEAMS are the subject under discussion in to-night's B.B.C. Home Service programme, "Taking Stock." One of the speakers is Mr. F. A. Martin, O.B.E., leader of the Steelfounders' Productivity Team, the first to visit the United States.

British Cast Iron Research Association

Annual Meeting in London

THE ANNUAL GENERAL MEETING of the British Cast Iron Research Association was held in the Waldorf Hotel, London, on November 15, the retiring president, Mr. P. H. Wilson. O.B.E., M.I.MECH.E., in the chair.

Report and Accounts

The chairman, proposing the adoption of the annual report* of the council and the audited and certified accounts for the year ended June 30, said the income of the Association had shown a marked increase since the arrangement was made with the Joint Iron Council two years ago. Much of the increase in that period had been devoted to new accommodation and equipment, and the results so far were shown by the opening of the new Scottish laboratory on May 5 and the opening of extensions at headquarters on July 5. Not all of that had yet been paid for, but the director had advised the council that the surplus income for those two years would cover the costs of those extensions. That in fact had been done; the actual cost was very near the estimate, and the increase over the estimate had been covered by a larger contribution from the Joint Iron Council.

Dealing with future policy, which was greatly exercising the minds of the council, Mr. Wilson said that some modest extensions were contemplated in the immediate future, the cost of which might be met out of income during the remaining three years of the present Department of Scientific and Industrial Research quinquennium. The council had agreed to proceed with those extensions, which should provide for some time to come really adequate accommodation for the Association's chemical and sands laboratories and more space for the development department, as well as provision for heavy stores.

He had made reference previously to the possibilities of regional laboratories, and to the example set in that connection by the *Association Technique de Fonderie*, which had nine such laboratories in operation in connection with their central technical headquarters for the industry. Their total annual expenditure for an industry of approximately half the size was about three times that of the British Association. The re-armament programme had emphasised the need for regional service, for the industry in this country comprised a large number of small firms, many of whom were unable to provide specialised metallurgical control, and whose fullest output could not be realised without it. That was a situation in which provision of regional laboratories was particularly attractive and, indeed, was the only way, if we bore in mind the limited number of specialists available and the relatively high cost of the equipment they might have to employ. He would like to feel, in addition, that there were a number of foundries in this country which were competent, by virtue of their present products and staff, to make materials of the highest possible quality, the output of which could be integrated with any emergency that might arise. Along those lines he believed the industry could make its maximum contribution for it was well dispersed and made use very largely of native raw materials.

On account of the change in view with respect to the scope of the Association's work, for example with respect to productivity and working conditions, it was not easy to predict the ultimate scale of the operations; but the council took the view that something of the order of double the present staff and income would be a suitable target.

Passing over the review of the well-established departments of the Association, the chairman referred to two particular points forming features of the year. The first concerned the operational research team, which had started work in the summer and which, although with only a nucleus so far, had won warm recognition from many of the member firms, whose foundries had been visited, for the common-sense approach to the subject. The chairman emphasised that those visits were made by invitation from the firms concerned, and the reports were confidential to them. Secondly, the Association had appointed an engineer who would also visit and advise members on problems relating to heating and ventilation and other means of meeting the requirements of the "Garrett" report. It was a small beginning but, he hoped, a significant one, and the Association would welcome application from members who would like to avail themselves of the particular services.

As the end of his term of office approached, Mr. Wilson said that, to do justice to the office of president, it demanded a fair amount of time, sometimes a measure of patience, some knowledge and experience of the subject, and an interest in it and the Association. He emphasised most emphatically that the Association was always on the look-out for men who could share in its expanding work and who felt impelled to make their contribution. They had not necessarily to be technically-minded; but those who participated in the work of the council and its committees, while they were very willing horses, would be very happy to share the load. On behalf of the council and of all members of the Association, the chairman expressed most sincere appreciation of the work which had been done during the past year by the director, Dr. J. G. Pearce, and the whole of his staff, and of the excellent results which had been obtained under the greatest difficulty in certain departments in the course of the development which had taken place during that period.

MR. COLIN GRESTY, seconding the adoption of the report and accounts, commented on one or two of the points raised by the chairman. First he

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mentioned the new foundry atmospheres committee and the appointment of a new member of the staff of the Association to deal with ventilation, and so on. As a member of the joint standing committee which had derived from the "Garrett" committee, he assured the meeting that that was a very important matter, because the pressure of the unions and the Factories Department was all towards making more and more regulations; the Association was proceeding very correctly in taking up the matter and providing a service for the benefit of all members.

New President

THE CHAIRMAN recalled that at a previous meeting Dr. J. E. Hurst, J.P., had been asked to accept the presidency of the Association. For some time, he had served as chairman of council, and for a great number of years he had taken a very great interest in the work of the Association, particularly on the research side. The Association could not have made a better choice, for Dr. Hurst had the work and the development of the Association very much at heart. It was a real pleasure to propose his appointment.

MR. J. J. SHEEHAN, seconding said that Dr. Hurst was distinguished in the industry and in research; and a great deal of his help to the industry had arisen from his own personal efforts. He would make a very worthy successor to Mr. Wilson. He had wide interests, too, in the chemical industry, and was just the man to occupy the position of president.

Honorary Membership for Retiring President

MR. H. FIELD proposed an expression of thanks to Mr. Wilson for his services to the Association as president and in other capacities, and put forward that he be elected an honorary member. The records of the Association, said Mr. Field, were full of sincere votes of thanks to Mr. Wilson for his services in various offices, and quite rightly so, and those services remained in the memories of those who had been connected with the Association for a very long time. It might be thought that the presidency of the Association was the highest honour that could be offered to any one of its members who had served it well; but he felt there was a still higher honour, that of election to honorary membership. The members, as an expression of their appreciation, asked him to accept this mark of esteem, and looked forward to his continued help in the future.

MR. G. R. SHOTTON, who seconded, said the council felt very enthusiastic about the work which Mr. Wilson had done for the Association; anyone who had seen the quietly efficient manner in which he had handled the business of the Association, and the work he had done behind the scenes, could not but be very grateful to him.

(The resolution was carried with acclamation.)

MR. P. H. WILSON, in his response, said how much he appreciated the members' generous gesture.

Vice-presidents

On the motion of MR. E. C. DICKINSON, seconded by MR. W. C. COLTON, the following were elected as vice-presidents:—

Mr. Robert Dickson, J.P.; Mr. T. M. Herbert, M.A.; Mr. T. McKenna; Mr. A. E. Pearce; Mr. W. Rennie; Mr. S. H. Russell; Mr. F. Scopes, president of the Joint Iron Council; and Mr. J. J. Sheehan, president of the Institute of British Foundrymen.

On the motion of MR. F. SCOPES, seconded by MR. G. H. JOHNSON, the Association accorded its warmest thanks to Mr. P. A. Abernethy and Sir William Griffiths, D.SC., who, with the new president, Dr. Hurst, retired in accordance with article 23.

On the proposal of DR. A. B. EVEREST, seconded by MR. F. A. WILSON, it was resolved that the following members of council retiring automatically under article 27, and being eligible, shall be re-elected:—

Mr. D. K. Barclay; Mr. V. Everard, J.P.; Mr. R. L. Handley; and Mr. G. R. Shotton.

Also, that the following members of council, co-opted during the year, be elected:—

Mr. E. C. Dickinson, M.MET.; and Mr. P. Major, F.C.A.; and Colonel H. H. Jackson be elected a member of council in succession to Mr. R. K. Nicholson (resigned).

It was explained by the director that the first group retired by ballot because, when the council was re-constituted two year ago, all the members of the council had resigned to facilitate that operation. So that last year and this year the retiring members of council were determined by ballot in accordance with Article 27, which required that one-third should do so. If that first group did not represent one-third, he drew attention to the fact that several members were already serving on the council by virtue of their election as vice-presidents: they were Mr. Herbert, Mr. Rennie, Dr. Pearce, Mr Russell, and Mr. Sheehan.

On the motion of MR. V. C. FAULKNER, seconded by DR. A. B. EVEREST, the meeting elected H. Overton, Salt & Company (chartered accountants) as auditors, pursuant to section 159 (2) of the Companies Act, 1948. Finally DR. A. B. EVEREST proposed and MR. F. A. WILSON seconded, a vote of thanks to the council, committees and sub-committees for their work during the year. The proposal was cordially received and on the motion of MR. N. R. REES, seconded by MR. R. L. HANDLEY, a hearty vote of thanks was accorded Mr. Wilson for having presided.

An extraordinary general meeting followed (Mr. P. H. Wilson presiding) at which a resolution was submitted in order to bring the Articles of Association into line with the Companies Act, 1948. Advantage was taken to make one or two other alterations as a consequence of the improved model Articles of Association issued by the D.S.I.R. for the guidance of new research associations. On the motion of MR. R. L. HANDLEY, seconded by MR. F. SCOPES, a resolution approving the proposed alterations was carried.

"Handyman" Compressor

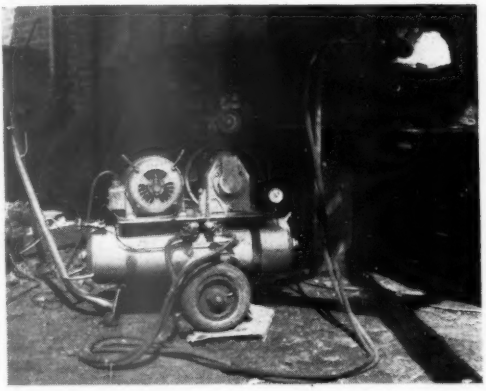
The Burtonwood Engineering Company, Limited, of Bryn, near Wigan, have designed and placed on the market a fully portable compressor, which has been found to be a real convenience in the foundry. In the accompanying illustrations the plant is shown being used for the kindling of a cupola and for the coating of a mould.

The output of the compressor is 6 cub. ft. per min., with an adjustable but maximum working pressure of 100 lb. per sq. in. The drive can be either by 1½ h.p., four-stroke petrol engine or by electric motor. For foundry use, where the burner is incorporated, the air receiver is divided into two adjacent tanks of approximately five and 2½ gallons respectively.

The front tank contains the fuel oil and this coming under pressure is forced up to an atomiser burner, simultaneously with the compressed air from the rear tank which causes a blast effect. This burner, when used for cupola lighting is mounted on a stand at a suitable height. The kindling time is about 10 to 15 min., and the cost is stated to be between 1s. and 1s. 6d. for the fuel oil.

Another use for the compressor is the spraying of plumbago and the like on mould surfaces, when a spray gun is connected to the air receiver, the required pressure being obtained by adjusting through a reducing valve. The skin-drying of moulds is a further potential use, whilst at weekends the equipment can be called on for spray painting the shop.

The apparatus is available in three models—one taking care of the petrol type and the other two varying voltages of electric-motor drive. The overall dimensions are 54 by 20 by 40 in. and the shipping weight 200 lb.



The "Handyman" Compressor in Action. It is being used with a Burner Attachment for Cupola Lighting (left) and with a Spray Gun for the Coating of a Mould (right).

German Foundrymen's Association

(*Continued from page* 454)

aspects of their work. A nationally-recognised examination qualifies them as fully trained for the foundry industry. For the first time, the idea of granting foremen and particularly foundry foremen the same official appreciation, as was always the case with foremen of other trades, became a reality. For the training of foundry technicians the foundry training college at Duisburg and the technical high school at Aachen are outstanding. Both schools were heavily damaged during the war, but the schools have been re-opened and a large section of the laboratories and theatres have, in the interim, been re-furnished with up-to-date equipment. For foundry technicians, the industry appreciates a practical training, *i.e.*, the student should have worked as an assistant in a foundry, after having served his probationary period. Generally speaking, the lecturer gave the impression that the V.D.G. was leading in the field of training the rising generation and that it will be its aim to reach, eventually, a degree of education for foundry foremen and technicians which will meet all technical developments and the enhanced competition in the world's market.

Foreign Foundry Machinery: Film Lecture, by A. Gollmer.

The comparison with the development and the degree of technical science abroad has always been a positive incentive for a lively competition in the world's market. Although the American foundry industry cannot and will not be looked upon as a model for German foundry re-equipment and organisation, owing to their more restricted and standardised production programme in the various works, it is nevertheless useful and expedient to watch carefully their endeavours towards complete mechanisation. It might be constructive if German foundries could plan more effectively and handle materials more economically in order to proceed from specialisation *via* mechanisation towards an economy for the benefit of the nation as a whole. Suggestions and methods for doing this were contained in the film, which showed, first of all, very effective fettling machinery. The simple transference of heavy manual work from the workman to the machine, as well as the dust-free working place, attracted the attention of the founders present.

News in Brief

BRITISH ELECTRICITY AUTHORITY has sold the business of Tricity Cookers, Limited, to Thorn Electrical Industries, Limited.

JAMES J. NIVEN & COMPANY, LIMITED, Wellington, North Island, are the New Zealand agents for the Hunslet Engine Company, Limited, Leeds.

J. COLLIS & SONS, LIMITED, Regent Square, Gray's Inn Road, London, W.C.1, have instituted a service scheme for users of their mechanical handling equipment.

THE ANGLO-SCOTTISH TOOL COMPANY, LIMITED, Gateshead, have received a £140,000 order from Thomas Hedley & Company, Limited, for automatic packaging machinery.

DURHAM COUNTY COUNCIL has ordered £26,000 worth of structural steelwork for a new college at Billingham-on-Tees from Wright, Anderson & Company, Limited, Gateshead.

SCOLS IRON CEMENT, the specialty of Major Robinson & Company, Limited, Manchester, has been adopted as an approved standard material for use by one of the Dominion railways.

THE SOLE AGENTS in the United Kingdom for "Jung" internal grinding machines manufactured in Berlin are now the Rockwell Machine Tool Company, Limited, Welsh Harp, Edgware Road, London, N.W.2.

A REQUEST for a committee of inquiry into the harsh effects of death duties on private companies, which necessitate the selling of control, has been made to the Chancellor of the Exchequer by the National Union of Manufacturers.

WOODS OF COLCHESTER, LIMITED (an associate company of the General Electric Company, Limited), are moving their London offices on Monday next to larger premises at 58/62, High Holborn, W.C.1 (telephone: Chancery 5474).

THE FIRST PART of a new £2,500,000 blast-furnace plant has been put into operation by the Sheepbridge Company, Limited, Sheepbridge, Derbyshire, and comprises a new pig-casting plant to replace the older method which has been used at the works for many years.

THE MINISTER OF SUPPLY has appointed Thomson McLintock & Company, 33, King William Street, London, E.C.4, and Cooper Bros. & Company, 14, George Street, Mansion House, London, E.C.4, to be the auditors of the accounts of the Iron and Steel Corporation for the corporation's first financial year.

SHAREHOLDERS OF Brown Bayley's Steel Works, Limited, Sheffield, are informed that the directors propose to hive off certain of the company's non-steelmaking assets, when their securities are acquired by the Iron and Steel Corporation on February 15. The scheme has received approval in principle and discussions are now proceeding upon the details.

CAPTAIN C. W. BYAS, R.N.(RETD.), is leaving England to-day on a 12,000-mile journey by car to Southern Rhodesia. During his trip Captain Byas is undertaking a survey for Tiltman Langley Laboratories, Limited, research and development engineers, of Redhill, Surrey, who are considering the possibility of extending their activities to Africa.

DURING THE VISIT of Princess Elizabeth to the Swindon locomotive works, Mr. C. T. Roberts, works manager, was presented to Her Highness while she was in the foundry. Alderman J. Bond, Mayor of Swindon, who is a piecework checker, had a long conversation with the Princess in the casting shop as she watched the pouring of a 1-ton engine cylinder casting. An open-sand mould of the words H.R.H. Princess Elizabeth was cast and the Princess went out of her way to congratulate Mr. W. Cole, a cylinder moulder with a record of 50 years' service.

Walsall Scheme for Foundry Training

A comprehensive apprenticeship and training scheme which could serve as the prototype for the whole country has come into operation in Walsall. The scheme, devised by the Walsall Foundry Joint Recruitment and Training Committee, has received the support of 36 out of the 48 foundry firms in the Walsall, Bloxwich and Brownhill areas.

The scheme embodies various improvements on former ones, including daytime release to the local technical college and the introduction of a craftsman's certificate on completion of training. Such training, complementary to training at the National Foundry Craft Training Centre at West Bromwich, would enable any ambitious youth to pass to the National Foundry College at Wolverhampton with the prospect of becoming qualified as an executive.

This month, 10 youths were released for daytime classes at the Walsall Technical College and four for classes at Wednesbury, representing a large percentage of boys under 18 employed locally in the industry. The apprenticeship period is five years.

The Committee considers that each foundry should train its own craftsmen for its own type of product and emphasises the importance of such training under production conditions where skill, practice and speed will be learned. Provision, too, is made to cover the theoretical knowledge so essential in foundrywork. The results of the scheme augur well for the future, as an increase of over eight per cent. in recruitment has already taken place.

Board Changes

FOSTER, YATES & THOM, LIMITED—Mr. R. Lucas has been appointed a director and general manager.

PREMIER METAL COMPANY OF SOUTH AFRICA, LIMITED—Mr. George Mace has been appointed a director.

SAMUEL OSBORN & COMPANY, LIMITED—Mr. S. E. Osborn has been elected chairman of the company, and Mr. F. A. Hurst, who will continue as managing director, as deputy chairman. Mr. B. C. Pye-Smith has been appointed a director.

STAVELEY IRON & CHEMICAL COMPANY, LIMITED—Mr. S. W. Martin, general manager of the Devonshire works, and Mr. M. C. Hanna, solicitor to the company, have been appointed to the board. Mr. Martin has been associated with the company for over 40 years and Mr. Hanna for over 20 years.

RUSTON & HORNSBY, LIMITED—Mr. J. H. W. Pawlyn, the chairman, is retiring at the end of the year. Mr. Pawlyn has been connected with the company for 31 years successively as director, deputy chairman, and latterly as chairman. The board has appointed Mr. W. J. Ruston to succeed Mr. Pawlyn as chairman, and Mr. H. Riggall will become deputy chairman Mr. Pawlyn will also be resigning his seat on the Ruston-Bucyrus board on December 31, and will be succeeded by Mr. E. R. Jones. Mr. J. R. Bergne-Coupland, works manager, and Mr. T. L. Kendall, marine manager, have been appointed directors of the company.

National Institute for the Blind

The annual report of the National Institute for the Blind, just issued, shows an excess of expenditure over income of over £44,000. This is a state of affairs which in the name of humanity must be rectified, and we appeal to our readers to send a donation along to the treasurer of the Institute at 224, Great Portland Street, London, W.1.

STANTON-DALE

REFINED PIG IRON

Designed to meet the demands of high quality castings, which are, strength, machineability and resistance to wear.

All these can be secured by using Stanton-Dale Refined Pig Iron in your cupolas.

The above illustration shows a group of castings made from this iron by a well known economiser maker.

PROMPT DELIVERY

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

Obituary

MR. F. W. RAIKES, who was chairman and joint managing director of Cordes (Dos Works), Limited, iron and steel rollers, etc., of Newport (Mon), has died at the age of 93.

MR. GEORGE WATSON, an expert iron-ore sampler, of Gateshead, has died at the age of 85. He retired 10 years ago from the service of J. & H. S. Pattinson, analytical chemists.

MR. W. H. WRIGHT, J.P., of Leicester, has died at the age of 87. In 1917 he took over management of Wright's Foundry, Leicester, and formed the limited company of Wright's Havelock Foundry Company, Limited, of which he became managing director.

MR. DONALD MURRAY, a former manager with Walkers, Parker & Company, Limited, Elswick Lead Works, Newcastle-upon-Tyne, died on Thursday of last week. Mr. Murray had been with the company for 50 years when he retired in 1938.

MR. WILLIAM T. F. TRUNCHION, former manager of Grafton Cranes, Limited, Bedford, died on November 13 at the age of 78. A member of the Institute of Mechanical Engineers, Mr. Trunchion was holder of the Whitworth Exhibition for 1894.

MR. WILLIAM MUIRHEAD, who has died at Falkirk, was one of the founder members of the Central Iron-moulders' Association, and president of the union's executive. He entered Falkirk Town Council in 1904 and continued a member until 1942, when he retired.

Wills

BELCHER, THOMAS, representative for the Union Steel & Manufacturing Company, Limited, Wolverhampton £9,645

BAYLISS, F. W., secretary of Archibald Kenrick & Sons, Limited, ironfounders, etc., of West Bromwich £1,902

BRUCE, ANDREW, assistant commercial manager of the Falkirk Iron Company, Limited, Falkirk (Stirlingshire) £7,664

WALLWIN, J. M., associated with Wallwin (Pumps), Limited, and Wallwin (Turning Machines), Limited, Warwick £79,031

WALL, W. C., head cashier with N. Greening & Sons, Limited, wirecloth manufacturers, etc., of Warrington (Lancs) £2,566

SOUTHERTON, RICHARD, of W. & T. Avery, Limited, weighing machine manufacturers, etc., of Soho Foundry, Birmingham, 40 ... ... £9,028

BUTLER, G. H., a former secretary of Naylor, Benzon & Company, Limited, iron, steel, metal, and ore merchants and exporters, of Gracechurch Street, London, E.C.3 ... ... £3,178

VERULAM, LORD, late chairman of Enfield Cables, Limited, Enfield Rolling Mills, Limited, Inbucon, Limited, Sternol, Limited, Sterns, Limited, and interested in other companies £19,028

FREEMAN, SIR RALPH, senior partner of Freeman, Fox & Partners, civil and consulting engineers, of Victoria Street, London, S.W.1, late a director of William Beardmore & Company, Limited, South Durham Steel & Iron Company, Limited, and the Cargo Fleet Iron Company, Limited ... £44,695

International Foundry Congress 1951

The International Congress of Foundry Technical Associations will be held in Belgium in 1951, from September 10 to 14. Most of the meetings and social events will take place at "Fabrimetal," 17, rue des Drapiers, Brussels. If sufficient members of the Institute of British Foundrymen and their ladies signify their intention to be present, arrangements will be made collectively for travel and accommodation. Those who desire to be kept informed are invited to communicate with the secretary of the Institute.

British Standards Institution

Steel Balls for Brinell Testing

The newly-issued Standard for steel balls for Brinell testing is a revision of B.S. 240:Pt.2, first published in November, 1929. Its scope is unchanged in that it specifies the hardness of balls used in carrying out Brinell tests, and having diameters of 10, 5, 2 and 1 mm. It requires that the standard method of determining this hardness shall be by a diamond pyramid hardness test, but specifies a reciprocal pressure test for use where a diamond hardness testing machine is not available, and sets out the hardness numbers determined by this alternative method.

The revision largely affects the hardness numbers set out in the table dealing with the two different methods specified. The new numbers have been calculated from a more-accurate formula, and a number of errors and inconsistencies discovered in the original have been corrected.

Copies of this standard may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1, price 2s. post free.

Manchester Branch Office

The British Standards Institution has opened a branch office at 12, Hilton Street, Manchester, 1 (telephone: Central 4856; telegrams: Bristandin, Manchester.). At this office a complete set of British Standards, some 1,600 in number, may be consulted and copies purchased if desired. Any information about the B.S.I. can be obtained from Mr. A. F. B. Nall, an assistant technical director of the Institution, who is in charge of the Manchester office.

Personal

MR. J. C. BRUCE JONES, of Jones & Campbell, Limited, ironfounders, Larbert, and associated firms, was recently presented with gifts from the employees on completion of 50 years' service.

MR. P. J. FERGUSON has been appointed export sales manager at the London office of the British Aluminium Company, Limited. His place as Scottish branch manager will be taken by MR. M. J. J. RICHARDS, of the company's Midland branch office.

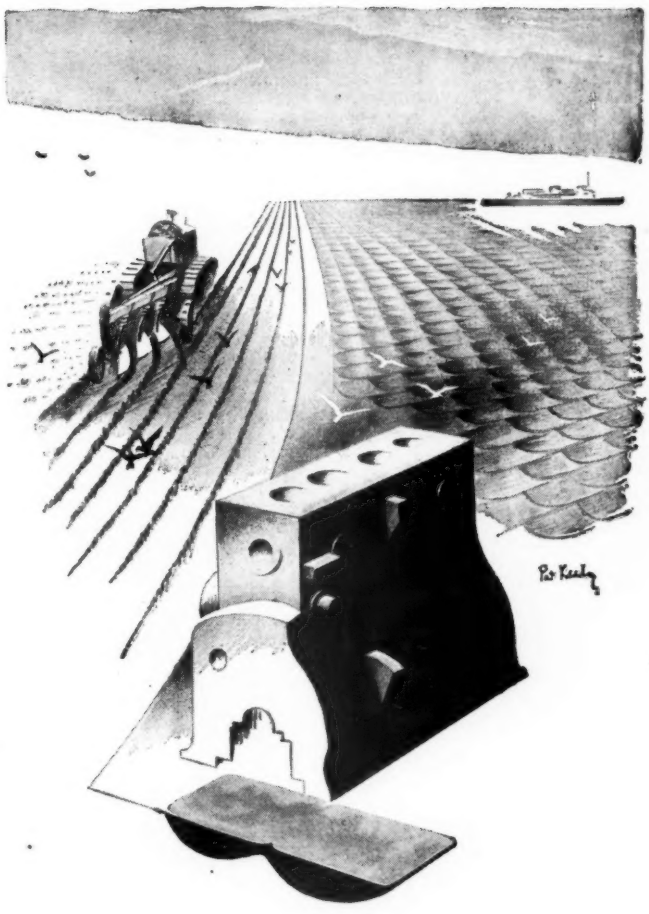
DR. H. E. DAVIES, chief metallurgist of the Park Gate Iron & Steel Company, Limited, has been appointed metallurgist to the British Electricity Authority in London.

MR. S. RICHARDS, of the Incandescent Heat Company, Limited, sailed last week for the United States. There he is using a model to demonstrate a new bar and tube heating furnace. The system employed embodies principles new to steelworks practice.

Fire Guards

A Press conference organised by the Women's Advisory Council on Solid Fuel revealed amongst other things that where fire guards were supplied by the makers of stoves they bore purchase tax, whereas if supplied separately they were tax-free. The Council asks that this ridiculous law be amended.

The Ministry of Fuel and Power has hitherto taken part in promoting domestic solid fuel efficiency; it has now been agreed, however, that this work shall be done by the Coal Utilisation Joint Council and the Women's Advisory Council jointly.



WORKINGTON CYLINDER IRONS

High-duty irons of suitable compositions for cylinders, chemical use, wear resistance and other special needs are readily achieved by using Workington Hematite Irons or "UCO" Cylinder Irons in the mixture.

Machine cast and free from sand and unwieldy pieces, of uniform composition throughout each cast, easily handled, quick melting, requiring much less coke and lime in the cupola than ordinary pig, they meet the requirements of modern foundry practice.

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WORKINGTON IRON & STEEL COMPANY

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W. 76

Raw Material Markets

Iron and Steel

The latest return shows that there are now 101 blast furnaces in effective production, the highest number since the end of last year, and pig-iron production is also at its highest peak during the current year. Still it is doubtful if immediate requirements have been fully overtaken. On a reduced allowance of scrap, the melting shops are consuming more pig-iron, and there has not yet been any marked improvement in the deliveries to the foundries. Light-castings establishments are fairly well supplied with high-phosphorus iron, but the call for low- and medium-phosphorus grades has expanded more rapidly than the output, and the use of substitute qualities is not infrequent.

On the whole, the necessary adjustments to the altered conditions in the re-rolling industry have been accomplished with remarkable smoothness. The swiftly developing revival in the demand for re-rolled products has imposed an increased call for semis at a time when European producers' prices were stiffening and offers of material were severely curtailed. Happily, British steelmakers have risen to the occasion. Good supplies of billets, sheet bars, and slabs are coming forward, and re-rollers have been able to take on substantial export orders, both for the current period and also for the early months of next year.

The overwhelming demand for sheet and strip steel has become a familiar feature, and since no immediate increase in output is possible, the continuance of the rationing system is clearly imperative. But shortages have also developed over a much wider range of products. Possibly some buyers are overstating their requirements in anticipation of greater difficulties during the course of the coming year. But the big tonnages of plates, angles, joists, and rails now being produced and distributed fail to keep pace with the rising demand, and some of the steelmakers are inclined to hold off the market until they have reduced current commitments.

Non-ferrous Metals

Figures published by the Copper Institute in New York show that for the month of October little change took place. Production of blister copper totalled 91,229 short tons, against 86,678 tons in September, while output of refined copper was 110,435 tons, compared with 111,842 tons in the previous month. Deliveries to consumers at 121,806 tons were about 2,000 tons up on the September figure of 119,529 tons. Stocks of refined copper declined from 58,748 tons at September 30 to 56,945 tons at the end of October. As will be seen from the gap of more than 30,000 tons between production of crude copper and deliveries to consumers, it is necessary for the United States to import freely from abroad. And, in addition, there is the demand in connection with stockpiling to be satisfied. Although the producers' price for copper remains unchanged at 24½ cents, the quotation ruling on the "grey" market is much above that level, for fabricators seem to be prepared to pay almost any figure in order to secure metal.

Similar conditions obtain in zinc, where, if anything, the situation is worse than in copper. Certainly in the United Kingdom, as consumers know to their cost, the supply position in zinc is more serious than in copper. So far, no further announcement has been made by the Ministry of Supply, and industry is being forced to the conclusion that activity next year will be brought down to the lower level dictated by a smaller tonnage of zinc. Demand for all zinc-bearing scrap continues to be as keen as ever, and the prices paid for secondary brass are a long way above the equivalent value in terms of virgin metal.

The tin market was not very active last week and the turnover did not amount to a great deal. Dealing is still mainly for the forward position and some interim dates, and there is no doubt that the market is decidedly short of prompt metal. Consumers continue to buy on a day-to-day basis, but it would seem that the bulk of the tin produced in this country is being absorbed by industry in the United Kingdom. Doubtless the balance, if any, is sold on the market.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £1,010 to £1,040; Friday, £1,040 to £1,045; Monday, £1,000 to £1,010; Tuesday, £1,060 to £1,065; Wednesday, £1,140 to £1,145.

Three Months—Thursday, £930 to £960; Friday, £980 to £985; Monday, £915 to £920; Tuesday, £945 to £950; Wednesday, £1,055 to £1,060.

Change in Policy

During the Buxton conference of the Institute of British Foundrymen, Mr. J. A. Reynolds took the opportunity during the course of one of the technical sessions to appeal for more papers of a practical character.

He said that he had attended the conferences for many years, and felt that this year the discussions had to some extent veered away from foundrymen's problems. In the Institute there were many practical men, who had to train young men not merely in the shovelling of sand into moulds, but to give them an understanding of the materials needed to be put into moulds.

In that connection papers presented to the conference at Cheltenham in 1949, by the aluminium industry (934 and 935) and others by the committees dealing with bronzes, etc., papers 938 and 939, all profusely illustrated, were of the type which would meet the needs of many people. From time to time he heard members complain that there were not enough papers on moulding; core making (*i.e.*, comparisons between various methods of machine moulding, such as Sandslinger *v.* jolter); the question of tolerances in castings; the actual results given by castings from the pressure point of view as distinct from density tests, and so on; whereas the problems discussed were becoming more academic and more metallurgical each year. They felt, and he also felt to a certain extent, that such subjects were already being well covered by the British Cast Iron Research Association, the Institute of Metals, the Non-ferrous Research Association, and other bodies. He urged that the Institute should try to obtain more papers on practical foundry problems as distinct from the purely metallurgical aspect. The chairman at the meeting assured Mr. Reynolds that his protest would be brought to the attention of the committee concerned with papers.

New Catalogue

Lever Box. "David" is the name which has been chosen by Thos. Summerson & Sons, Limited, Darlington, Co. Durham, for a new type of lever box used for switching over the points on railway sidings. Instead of a back-straining pull, a mere flick of the lever arm and the job is accomplished. Foundries operating railway sidings should write to Darlington for a leaflet which describes and illustrates "David."